ELECTRICAL REVIEW

Vol. CXLIX 7th SEPTEMBER, 1951 No. 3850

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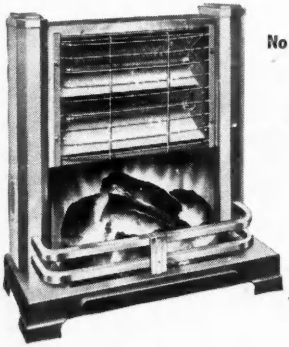

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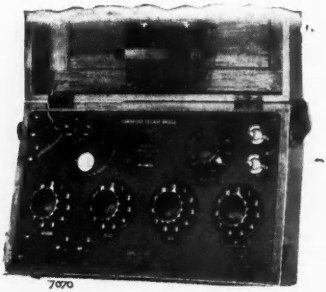

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ELECTRICAL REVIEW

Vol CXLIX No. 3350 7TH SEPTEMBER, 1951

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

Prices and Employment

EXPERIENCE IMPARTS A STERN LESSON

HISTORY teaches us that nobody ever learned anything from history. It is not necessary to read the papers, or listen to the radio, for very long to find examples of the truth of this observation. Price control is in the limelight and profit appears to be regarded as wicked. Let us see how this view can affect our industry.

Lack of Security

At the beginning of this century there was no restriction on competition, foreign or other. Prices were low, there were no profits and many companies suffered capital reductions. Some may say loss of capital does not matter, but what was the effect on the workpeople? If orders were obtained, men were wanted; if not, they weren't. When an important contract was advertised, firms would engage engineers in the hope that they would secure it and be able to employ them. If nothing came in they were out again and back to answering the advertisements (if any) in the technical journals. Trade unions have put an end to competition in wage rates, though not all engineering workers are covered even now.

In the second decade of the century it was generally realized that the prices of some kinds of apparatus were below cost, so when some makers agreed on minimum prices few were surprised, though some objected. Prices must be such that a competent staff can be maintained for sales, service, research and development. They must be reasonable, but the question " What does reasonable mean? " has to be answered. An unjustly high price will always fail in its object because, first, only those who can afford it will buy and, secondly, others will offer cheaper competitive devices. The " reasonable " price will enable the buyer to come back and buy all he needs without feeling that he has no option but to pay what is demanded, as everyone feels to-day about fuel.

Price Basis

The price agreed between a willing buyer and a willing seller is usually not far wrong, and controlled prices can be set up on that basis. There is nothing in the suggestion that control of prices protects inefficiency. If competition is transferred from price to quality and service, the most efficient will always come to the front.

A recent broadcast talk about the 'twenties pointed out that they ended with a crippled heavy industry, but memories are short. It is now suggested by some that there is no need, e.g., for

the transport service to be self-supporting—why then should suppliers of fuel or electricity have to earn profits? Obviously subsidies cannot be applied to all things.

" Each productive labourer, as he works, creates his own wages, and with every additional labourer there is an addition to the true wages fund—an addition to the common stock of wealth, which, generally speaking, is considerably greater than the amount he draws in wages." So wrote Henry George in 1880 (" Progress and Poverty"). He was wise enough to recognize that shop worker and management are alike " productive labourers " and that capital has its part to play. The selling price (particularly in the export market) must therefore not be inadequate. In our eagerness for a better future, do not let us forget the lessons of the past.

DISTRICT HEATING

Figures given by Mr. Oliver Lyle in our " Correspondence " section regarding the heat efficiency of small back-pressure turbines are not in dispute. Where electricity is generated as a by-product of process steam, the use of such plant is generally justifiable. The steam rate of large condensing steam turbines, which provide upward of 50,000 million kWh a year, more than half of which is used in factories, is, however, another matter. So are the difficulties likely to be encountered in distributing heat over a large area. We agree that electricity interests need not be unduly sensitive about district heating. There are likely to be few cases in which it will be economically feasible.

CONTRACTORS COMBINE

Long before nationalization we contended that electrical contractors could only survive in the face of growing competition from electricity supply authorities by forming groups in their respective localities. From time to time (particularly during the war) there have been cases of contracting firms getting together in a substantial way but usually co-operation has been of a rather loose character, taking the form merely of joint advertising, combined exhibits and the like. Now from Plymouth comes news that local members of the Electrical Contractors' Association have formed a company whose principal object is to undertake electrical maintenance work for the Plymouth Corporation. Hitherto the whole of this work has been done by the South Western Electricity Board; now it will be shared between the two organizations.

BOARDS' EXPENDITURE

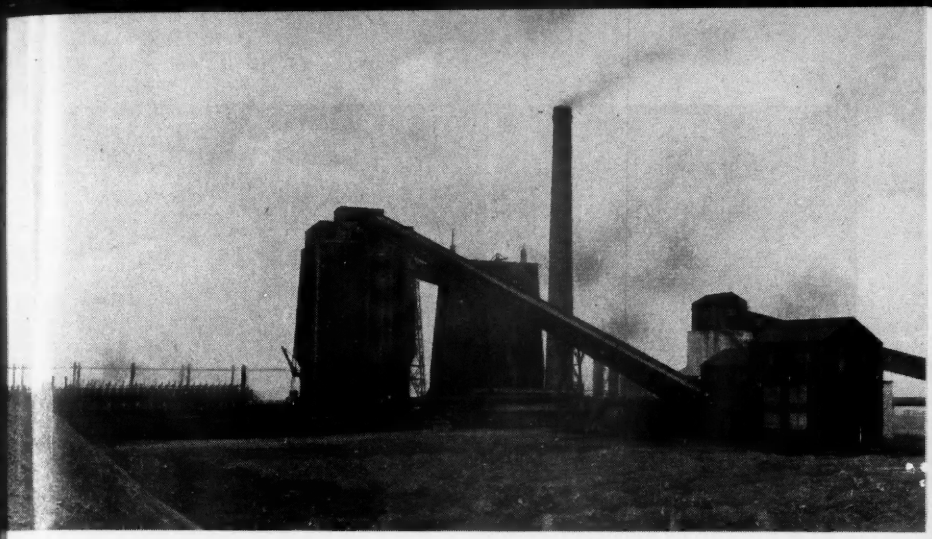
No figures were given this year of the exact amount of permitted capital expenditure by the Electricity Boards but it was suggested that there would be a substantial curtailment. The result has been that some of the Boards have had to slow down development considerably and in some cases to announce their inability to connect new consumers. The public's concern, voiced by a number of local authorities, has evidently had some influence with the Government for it is believed that there has been some relaxation of the restrictions on expenditure; but how far and how much is not known in the absence of any statement.

TESTING FOR CANADA

It appears that not all British electrical manufacturers are aware of the system set up in this country under the ægis of the British Standards Institution whereby tests are made to decide whether equipment is suitable for the Canadian market. Since the scheme began last year about 270 applications for approval have been received by the B.S.I. and all but 20 per cent of these have been dealt with in this country. In the balance of cases the equipment has been sent to Canada for test. In this way manufacturers have been saved much time and trouble and those who have not yet used the system should get into touch with the B.S.I./C.S.A. Approvals Division.

WELDING ELECTRODES

Apart from its value as an aid to the selection and storage of arc welding electrodes, the recently published B.E.A.M.A. Guide is a useful reminder of the rapidity with which the employment of the flux coated types is extending. The footage of electrodes made last year reached 1,111 million, which means that United Kingdom industries used 285 per cent more in 1950 than they did in 1938, and 425 per cent more electrodes were exported last year than in 1938. Other remarkable statistics show that the number of new " operator units "—arc welding plants—installed in this country last year was 6,720 and that during the last four years welding sets for about 25,000 operators have been delivered to British industries.



New Coke Oven Installation

Part of Large Steelworks Reconstruction

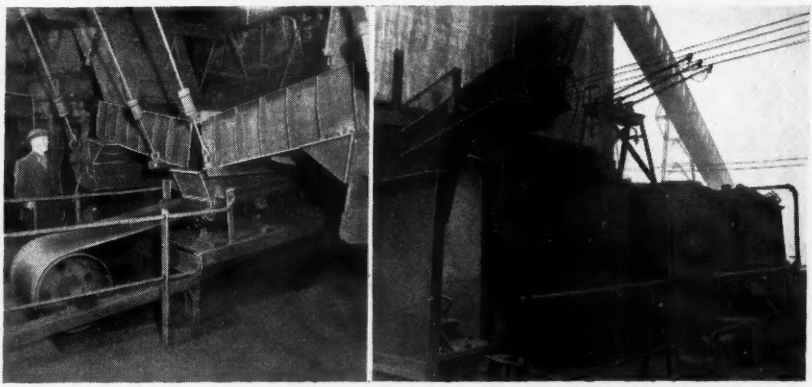
IN the description of the new power station at the steelworks at Consett of the Consett Iron Co., Ltd., in the *Electrical Review* of 10th August, it was explained that the power station was but part of a very comprehensive scheme of reconstruction of the whole works, started in 1940 and likely to be completed in 1953.

This reconstruction scheme includes, *inter alia*, the erection of an additional battery of 54 Becker coke ovens at the Fell Coke Works. This battery occupies a ground area of roughly 300ft by 50ft, and is about 50ft high overall. About 15,000 tons of coal per week are carbonized in the new ovens, but the coal handling plant deals with an average of about 200 tons per hour for both the new battery and an existing Wilputte battery which is now being extended. The coal is brought to the works by rail trucks and tipped into a hopper at a level of about 40ft above ground.

At the outlet of the hopper the coal is fed on to conveyor A by two Sherwen magnetic vibrators supplied with a.c. at 500 V single-phase. At the top of conveyor A is a magnetic pulley for the separation of tramp iron. This conveyor is driven by a 30 h.p. squirrel-cage motor which is directly started by an Allen West push-button contactor unit.

From the top of the conveyor the coal falls into one of two hammer crushers, each of which is driven directly by a 350 h.p. slip-ring 500 V motor with an Allen West liquid rotor resistance. The crushed coal falls into a hopper at the bottom of which is a " Syntron " vibrator which helps the damp coal out of the hopper on to a belt C. This conveyor, which has a 50 h.p. motor drive, carries the coal to the top of a very high storage bunker which is constructed vertically above the actual oven battery which it feeds. At the top of this storage bunker is a set of slip rings which allows a platform to revolve on a monorail. On this rotating platform is a shuttle belt conveyor which can move along the rotating platform so that it can tip coal into any

Above: **The new coke oven battery is served by comprehensive coal handling plant, including a very large storage bunker**



Left: **Magnetic vibrating feeders pass coal from the hopper to the crushing machinery conveyor.**
Right: **The larry, shown in position to receive coal from storage bunker, is supplied from an overhead distribution system with trolley wheel pick-up arms**

of the vertical compartments in the bunker. Both the shuttle conveyor and the revolving platform motors, 5 h.p. each, are fed from overhead conductors by brush pick-up equipment. The shuttle motor serves both the conveyor proper and for its own travel along the platform.

The feeder, conveyor A, crusher, conveyor C and shuttle conveyor motors are all arranged in a system of sequence control whereby, in the opposite direction to the flow of coal, the forward motor in each case cannot be started up until the rear motor is running. All the motors are started automatically, with one exception, i.e., the crusher motor, which is started up by hand. This sequence control scheme which embraces relays in the starters, each of which automatically operates the corresponding motor in the sequence, is incorporated in an Allen West control panel. All the motors on the coal handling plant are L.D.C. machines and both the motors and the switchgear are of flameproof design because of the presence of coal dust.

Coal from the storage bunker is fed down by valves as required into the four tubs of a coal larry, i.e., a specially designed electrically driven vehicle which travels actually on and along the entire length of the battery and thus feeds with coal any of the individual ovens where required. The four tubs have a minimum overall capacity of 18 tons. At the bottom of each tub is a 500 V single-phase Sherwen vibrator to outfeed the coal and a pair of slides which are lowered to guide the coal down when feeding is taking place. These slides are interlocked with the 30 h.p. slip-ring travel motor on the larry, so as to prevent travel when the slides are down. There are four charging holes at the top of each oven, side to side, corresponding with the four aligned tubs on the larry. Two winches on the larry serve for cleaning the ascension gas pipes.

In common with all the oven machinery motors the 30 h.p. larry motor is a Bruce Peebles equipment, and it is controlled by a B.T.H. drum type starter. A metal rectifier on the larry provides rectified a.c. which is superimposed on a normal a.c. supply for serving the Sherwen magnetic vibrating feeders at the bottom of the tubs for feeding the coal to the ovens. The larry is supplied from an overhead trolley wire distribution scheme of four wires (one spare) for three-phase a.c. The system includes the three collector arms, one per phase.

The coking period is about 16 hours, after which time the hot coke is ejected by a pushing machine on one side of the ovens. This machine is a huge structure which runs on rails spaced at about 30ft at near ground level. It has four pairs of wheels, each pair having a separate drive by a 15 h.p. a.c. motor. The four motors are all controlled through one set of Allen West starting equipment, i.e., one stator switch is directly connected to all four stators, and the rotor circuits of all four

motors are brought out to a common rotor resistance at the third step of which all the rotor circuits are paralleled to an equalizing resistance.

There are three sectional movements—the pusher beam (centre), the leveller and the door rack extractor. The beam, which is simply a ramrod to press the hot coke right through each oven, is driven by an 80 h.p. slip-ring motor, which transmits through a wide ratio " Radicon " reducing gear and finally through a pinion gear on to a rack on the beam itself. The motor is controlled by an Allen West stator switch and a rotor regulating resistance. The leveller is driven by a 30 h.p. directly started slip-ring motor, and the door rack extractor is operated by a directly started squirrel-cage motor.

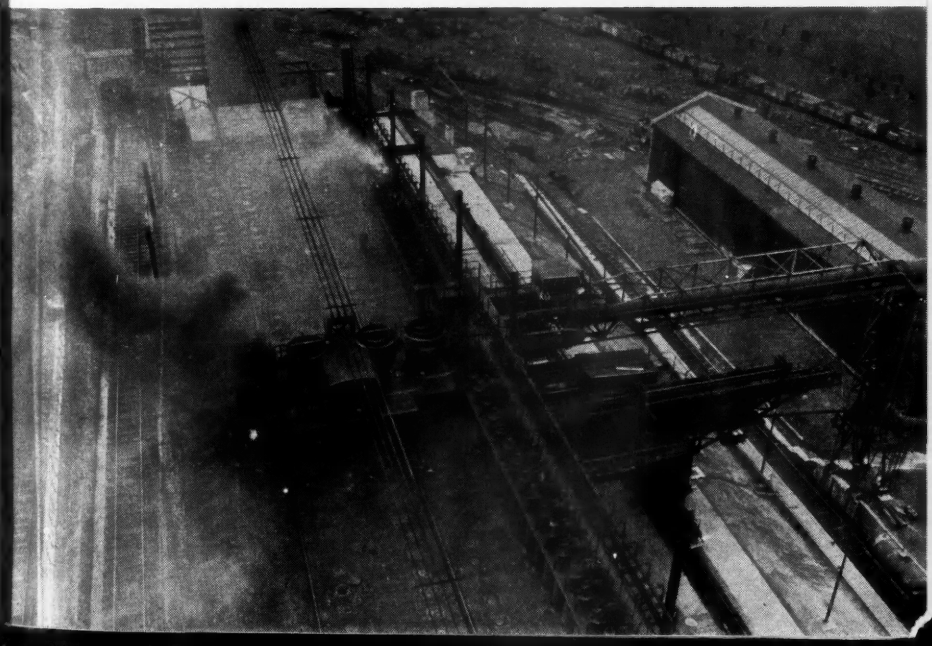
On the door rack is a door hook, served by a 2½ h.p. motor, for lifting clear the fixing bars which hold the doors on to the ovens. All the movements on the pushing machine are fully interlocked. In the event of any of the interlocks or limit switches being rendered ineffective a by-pass switch allows the driver to operate his machine without them. The interlocks and limit switches are all Allen West gear.

On the other side of the oven battery is a travelling machine which guides the hot coke into a car. The guide runs on rails spaced at about 6ft and at about 20ft above ground level. It is driven by a 15 h.p. slip-ring motor, but it carries also a 5 h.p. motor which serves for door removing and replacing and door slewing, and there is also a motor which lifts off the bars which fix the doors to the ovens.

It is necessary to ensure that both the pusher and the guide are operating together at any one time in conjunction with the same oven. To this end there is a controlling contactor coil on the pusher forward movement, and only on the completion of the circuit containing this can the movement be put into operation. Further, this circuit can be completed only when one of the conductors of cable which run under the oven structures, makes suitable contact with both the pusher gear on one side and the guide unit on the other side simultaneously. This interlocking scheme was devised and installed by the Fell Coke Works electrical engineering department.

There are two electrically driven travelling clay carriers which provide the necessary means of access to the oven doors on the replacement of these by the door handling equipments on the pusher and guide machines, respectively. Both of these clay carriers run on rails along the whole length of the oven battery and at

The larry runs along the whole length of the coke oven battery, on rails on top of the battery

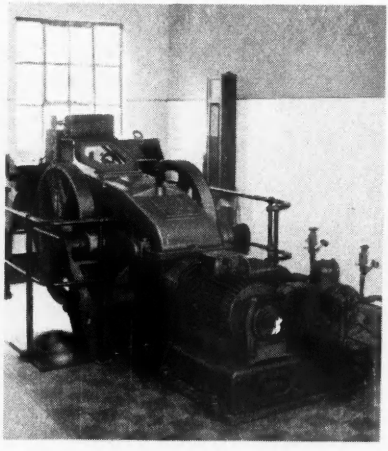


about 20ft above ground level, on one side between the pusher and the oven battery and on the other side on the same track as the guide. Each clay carrier transports the man who applies the clay as well as the clay itself and it also contains a man lift by which the operator can place himself in the required vertical position for the application of the clay. The travel motion has a 2½ h.p. squirrel-cage motor drive, and the man lift is driven by a similar motor.

The car, which receives the hot coke from the guide, runs on rails at about ground level and is hauled by an electric locomotive. This locomotive has two 90 h.p. 250 V d.c. series motors, running in series.

On this locomotive are also two air compressors which provide for the pneumatic operation of the coke car gates and for braking. Each compressor is driven by a 10 h.p. d.c. series motor under the control of an automatic pressure switch. The pusher, the guide, the two clay carriers and the coke car locomotive are supplied from their own bare conductors and sliding pick-up distribution scheme. On the pusher overhead system there are six trolley wires: three for power purposes, one for the 50 V interlocking scheme and two for visual and audible signals operating at 110 V. The distribution systems for the other four equipments are more simple and consist of bare conductor bars suspended overhead or bracketed to the walls of the coke over structure, with simple sliding pick-ups.

The direction of flow of the gas through the ovens is changed automatically by motor-driven cams through very high ratio gearing

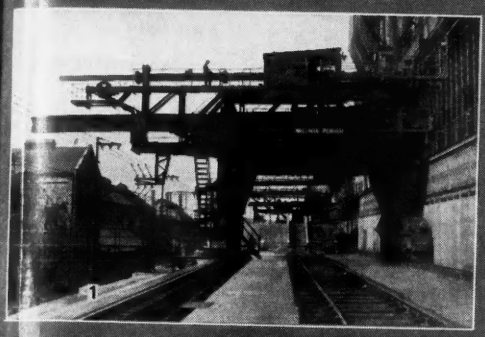


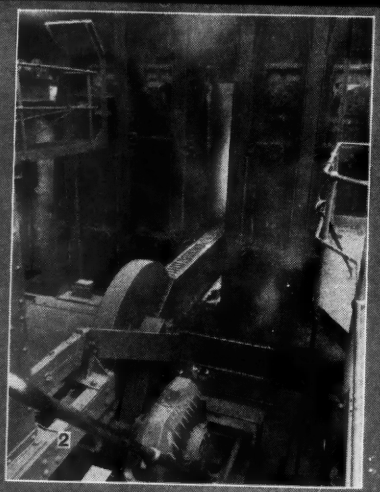
The hot coke in the coke car is hauled along to a quenching tower where it is cooled by water sprays for a predetermined time by means of valves operated automatically by B.T.H. thrustors and timers.

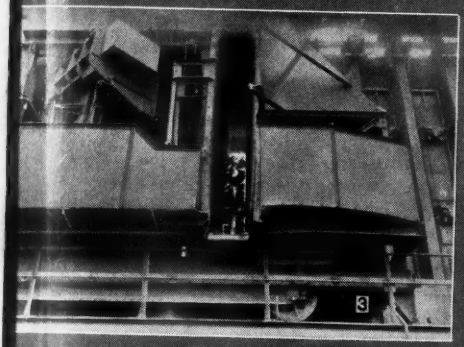
From the quenching tower the coke is passed on to a coke wharf and then conveyed to two sets of screens. From the primary screens the large coke is conveyed to the blast furnaces, another section of the major reconstruction, and the finer coke is conveyed to the secondary screens by which it is suitably graded for household supplies. The rejected coke from the secondary screens is returned to a rod mill near the crushers of the coal handling plant where the stream of coal into the storage bunkers is augmented by a stream of coke from the screens, via the rod mill crusher which is driven by a 120 h.p. squirrel-cage L.D.C. motor which is directly started by an Allen West push-button contactor starter.

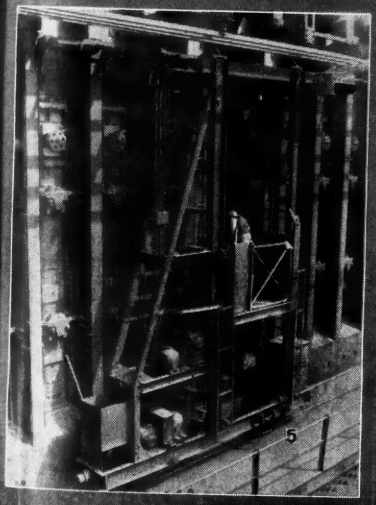
The gas drawn from the coke ovens is passed through a by-products plant which yields such materials as benzole, naphthalene, sulphate of ammonia and tar. The stripped gas is passed on for firing the steel making furnaces in the melting shop, another part of the reconstruction scheme. Lower quality gas produced by the blast furnaces is rich enough to fire the coke ovens. In order to heat the coal in the ovens evenly this blast furnace gas is applied to each side of the ovens in turn, the change-over being effected automatically every half-hour in the following way. A very high ratio gearing is driven by an electric motor which is operated under the time control of an impulse clock. On either side of the gearing on the output shaft is a pulley with cams—one cam normal (bulge) and the other one reversed (dent). These cams operate a system of levers which reverse the air and gas dampers, so as to reverse the direction of the air and gas through the ovens every half-hour.

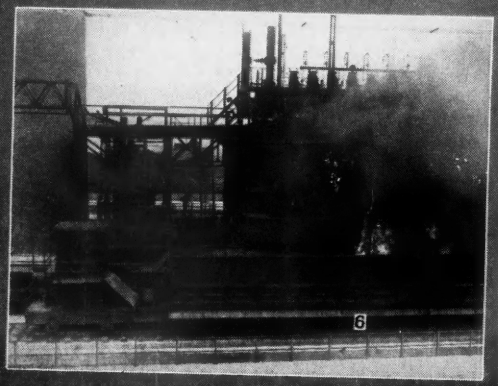
We are indebted to Mr. H. Boot, managing director, Consett Iron Co., Ltd., for permission to view the coke oven plant and to publish this article, and to Mr. F. B. George, director and works manager (development), and Mr. T. Coxon, consulting electrical engineer, for their help.











(1) The pushing machine runs on widely spaced rails near ground level, and has a four-motor travelling drive. (2) The pusher beam, shown well into one of the ovens, has an 80 h.p. motor drive. (3) The guide receives coke from the oven on its way to the coke car. (4) The guide is served by an overhead bar distribution system with pick-up arms. (5) On each side of the oven battery is a clay carrier which incorporates a man lift. (6) The coke car, shown receiving hot coke from ovens, is hauled by an electric locomotive

VIEWS on the NEWS

By REFLECTOR

ELECTRICITY authorities in their endeavour to meet the demands of rural dwellers are torn between their desire not to disfigure the countryside and their obligation to provide electric power as cheaply as possible. The two aims are rarely compatible and the best that can be hoped for is a compromise. A booklet published by the East Midlands Electricity Board sets out the various factors involved and the way in which the Board tries to meet the requirements of conflicting interests. The publication, which I am told represents the considered views of the B.E.A. and the other Electricity Boards, should go some way toward removing the rancour from the frequent differences in which these authorities are caught up.

* * *

It is natural, I suppose, for the public to wonder about the propriety of seaside illuminations at a time when there is said to be a shortage of electric power. Letters continue to appear in the daily Press complaining that people are being deprived of electricity while these lights blaze away. But one letter I have seen is from a man who has been persuaded that this is not really so. He asks, however, why in this case people are not encouraged to use more electricity in the evenings by the granting of cheaper rates. Another point of view has been put by a " spokesman " of the North Western Electricity Board who says that actually the sale of electricity for these illuminations cheapens the general supply by filling in the load-curve " valley."

* * *

An Australian correspondent tells me that an invention which, it is claimed, will provide unlimited cheap electric power and has now been perfected for commercial use, was recently demonstrated to a gathering in a dairy shed at Urunga, on the north coast of New South Wales. The inventor is a 32-year-old cinema proprietor, who has declined to reveal the principle of his invention. Wide publicity has been given to the claim and it is stated that U.S. firms have shown interest. The correspondent says that " similar claims made in the past have been without foundation and this one will be viewed with some suspicion until further proofs are forthcoming." These inventions used to come from Central Europe. I am afraid that the greater distance does not add to their credibility.

* * *

Frequency reductions have played havoc with electric timekeeping and have had repercussions in other directions but until I saw a report in the *Grimsby News* I had not come across a case of organ trouble. In Cleethorpes there is a man who gives daily recitals on an electric (Hammond) organ. He has found that a slight variation in frequency puts his instrument off pitch which is fatal to one of his feats—playing a piano with one hand and the organ with the other.

* * *

A writer in the *Leicester Evening Mail*, referring to the suggestion that laid-up ships might be used as power plants, says, rather inconsequently, that after the 1914–18 war Loughborough College purchased a former U-boat engine from the Admiralty and produced sufficient power to light its central buildings for more than twenty years. I recall that Southend Corporation went further than this and acquired eight or nine submarine diesel sets from which it supplied power to a large part of its area. But these were hardly floating power stations.

* * *

" Power Plant Built in Fifty Days " announces a heading in the *Daily Worker*. Upon reading the subjoined matter I was not surprised to find that this was another Russian achievement. The paragraph inspiring the heading reads as follows:—

> " The Stalin Works, where the first water-turbine for the Tsimliansk Hydro-Electric Station was recently finished in 50 days, will complete the second in August and the third in October."

A solitary water turbine is hardly a power plant; and what does the *Daily Worker* mean by " finished " ?

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Power Station Engineers' Salaries

THOSE of us at the present time who are unfortunate enough to have made careers in the power industry are continuously being told at branch meetings of the E.P.E.A. that no other body of professional workers have since the war been as well catered for as ourselves. This apparently is considered good enough with which to pay the accounts of the butcher and greengrocer.

Our relative conditions have now deteriorated to such an extent that a police constable is paid £505 per annum, plus free house, uniform and boots, all of which is officially stated to be equal to £675 per annum, equivalent to a shift charge engineer's remuneration. The only qualifications necessary are—" to be less than 30 years of age, height not less than 5ft 9in, chest measurement 36in deflated."

Is it any wonder that the B.E.A. is crying out for station engineers or that there is discontent and dissatisfaction within the ranks of the E.P.E.A.?

DISGRUNTLED ENGINEER.

" Ridiculous " Electricity Tariffs

" REFLECTOR " draws attention to trouble caused by the new standard tariff, but hasn't there always been a little trouble in that direction? Many years ago I overheard a gentleman at the counter of a Survey Department telling an official in no uncertain terms that the supply authority had no concern with what he used his current for as it was passing through a meter and he was paying for it.

The layman cannot be blamed for feeling that the method of charging for electricity is " haywire " and he treats electricity, as it naturally is—a commodity, just as paint, soap and other such necessities. Why should he be charged on the number of rooms or on the number of installed lighting points, also why should the charge not be the same for light, power and heat? The unfairness under the number of points system is obvious as the person with one 60 W lighting point is quickly entitled to a lower rate, whereas the firm with two or three hundred points may never enjoy the cheaper rate.

If a flat rate were charged for all electricity consumed there would be less grumbling and ordinary people would have no difficulty in deciphering their electricity accounts. Charging for electricity on the number of apartments is just plain ridiculous.

Glasgow. ALEX. MILNE, Senr.

Obstinate Customers

IN the majority of businesses, the customer is " always right " but it is difficult to apply that principle in a properly run electrical establishment. I refer to those people who wish to have two-pin plugs fitted to radiators and other such things; it is often difficult and sometimes impossible to convince people that two-pin plugs are " asking for trouble." It is very seldom that one finds an absolutely earth-free situation and it is a pity that two-pin plugs and sockets cannot be entirely eliminated.

Many years ago a lady informed me that as she was paying for what she required I had no right to argue with her and when I walked away she got a plumber to do the work. Quite recently another lady brought in a nice radiator which was fitted with three-core t.r.s. flexible of the correct diameter and a 15 A three-pin plug. She merely wanted a longer flexible fitted and this was duly attended to but when she returned to collect the radiator she pointed out to the electrician that three-pin plugs were no use to her as all her sockets were the small size with two " prongs."

On this being referred to me, I duly explained all the circumstances to the lady and as she stated there were no earthed conductors in the room in which the radiator was used, I promptly went along to examine the situation and found gas pipes and a gas fire in the room. To cut

the story short, she thanked me for the interest I had taken and stated that she would take all responsibility, but would she be morally responsible if anything happened?

These are the things which have caused me to be a firm advocate of compulsory rules.

CONTRACTOR.

District Heating

YOUR leading article of 24th August refers to the recent correspondence in *The Times* on district heating. In your article the astonishing statement is made that the elimination of condensers would very materially interfere with the efficiency of steam turbines.

The writer of the article is confusing steam rate with efficiency. Steam rate is indeed a measure of condensing efficiency, but it has nothing whatever to do with the efficiency of back-pressure machines. The losses in the latter are radiation, bearing, friction and gland leaks. All the big losses, blade losses, interstage leaks, etc., together with the latent heat go down the exhaust pipe into the heating process. The efficiency of power generation by a back-pressure machine of about 10 MW would probably be:

Boiler efficiency	.. ..	84 per cent
Turbine „	.. ..	93 „
Generator „	.. ..	94 „
Combined	„ $84 \times 0{\cdot}93 \times 0{\cdot}94 = 73$	„

compared with about 29 per cent in the good condensing stations.

The coal consumption at 73 per cent efficiency with coal of 11,000 B.Th.U./lb would be:

$$\frac{3415}{11{,}000 \times 0{\cdot}73} = 0{\cdot}425 \text{ lb/kWh}$$

As coal represents three-fifths of electricity generating costs, the saving of about three-fifths of this coal will reduce the cost of generation by about one-third.

The Pimlico scheme will provide figures, but will they be of use? The Battersea back-pressure turbines exhaust into surface condensers, which, I am told, have a temperature difference between exhaust steam and district heating water of 20 deg F. Proper back-pressure technique calls for a jet condenser with no temperature drop, thus enabling the turbines to give another 8 per cent or so of electricity from the same steam.

The Pimlico scheme contains a huge hot water reservoir, because the Battersea folk must have their " firm power " with constant load and intermittent running. Less bigoted people excuse the heat reservoir by calling it a safeguard against boiler breakdown, thus saving a theoretical spare boiler. But the reservoir only holds one day's heat so what happens without a spare boiler (theoretical) at annual survey?

Had the Pimlico/Battersea scheme been fitted with a jet condenser and were the turbines run to give the heat needed, electricity being a by-product, useful figures might have been obtained.

The B.E.A. programme calls for nearly twice the present coal in ten years' time. This just about mops up the problematical coal production increase of the " Plan for Coal," leaving nothing for anyone else.

Gas turbines may play a small part as peak-meeters, but, as far as I know, no gas turbine anywhere has run more than 7,000 hours, nor is 35 per cent efficiency much to boast about when back-pressure working can give 70 per cent without difficulty. There is a great store of back-pressure " know-how " and experience outside the electricity generating industry. The sugar industry, for example, has been working back pressure for about 130 years—twice as long as the life of the electricity generating industry.

There is no need for the electricity interests to be so sensitive about district heating—*qui s'excuse s'accuse.* Somehow or other the generation of power by steam has got to be justified and it cannot be done condensing at 29 per cent efficiency.

London, E.C.2. OLIVER LYLE.

[Reference is made to this letter in a leaderette.—Editors, *Electrical Review.*]

Maximum Demand Indicators

WHEN I see the ingenuity which goes into the design of electricity meters I bow my humble head upon the gate and therefore it is with trepidation that I beg to ask the following questions regarding maximum demand indicators.

1. There is a " pusher " needle, which activates at predetermined intervals the " non-return " needle indicating the maximum demand over the re-setting periods. Why is this " pusher " needle frequently manufactured as a puny tear-drop instead of being a bold, aggressive needle of the same length as the non-return needle

which would enable consumers to take an intelligent interest in their demand, locate the culprits of heavy loading as to time, and take steps to spread the load?

2. Why is the timing clock dial not brought out to the front, as in the Hill-Shotter type?

3. Are meter designers ever asked to evaluate on site the loading conditions of a factory from every angle of time, kW, kVA and kVAr, using only the m.d.i. instruments which they have designed?

Car owners have often expressed the pious wish "that the designer of this so-and-so car should have been forced to dismantle it and put it back together again" the while sucking a bruised knuckle. There go I, in a different sense, with meters, but I do not know how to suck a bruised spirit: liqueurs excepted.

KILOVAR.

Power Cuts and Relays

ARE we all accepting the loss of production time and general inconvenience caused by load shedding and power cuts too passively?

Much could be done to minimize the ill effects long before new generating plant becomes available. As it appears not to be possible for generation to catch up with the load for years to come, surely the B.E.A. should consider installing, throughout its systems, close differential voltage relays to disconnect load in inverse order of importance as the feeder voltage is reduced. By the use of such relays any desired order of load shedding could be obtained.

For example, a reduction of voltage of, say, 10 per cent would automatically cut out domestic water heaters and comparatively unimportant industrial processes. A further reduction of 10 per cent of the voltage would cut domestic heating and non-essential factory loads. Corresponding increases of supply voltage would pick up the loads again automatically.

Relays of the type referred to, working to a differential as close as plus or minus 2 per cent and having a time delay feature to prevent "hunting" on fluctuating voltage, are made by several firms in this country, including my own; they are not particularly expensive and are simple and reliable.

Although such a scheme would undoubtedly cost a very considerable sum of money to install, the advantages from the operating point of view should be very great and the prevention of production interruption would, I believe, make it an economical proposition from the country's point of view.

W. S. FORSTER BROWN,
Director,
Magnetic Controls, Ltd.

London, S.W.3.

Peak Load Control

THE salient fact emerging from Mr. Crowsley's letters on the above subject is his acknowledgment that peak load problems exist but, in his opinion, the degree of control suggested by me cannot be implemented, a view shared by Mr. Butterworth. While I am quite certain that these are sincere opinions they remain such until supported by precise technical data, when they become fact.

That only meagre information is available on the composition of various loads and their diversity is supported by one Area Board which is installing recording apparatus to determine this.

As a member of the staff of a supply authority, my activities in 1939 were directed to providing some means of peak load control which was at that time causing embarrassment, and the installation of a current limiter with a fixed charge based on its setting was being considered.

The time at which a peak load occurs is largely a reflection of the development programme of the undertaking. Until the introduction of the two-part tariff system, lighting caused the peak, but in the late 20's it moved to the mid-day cooking load, especially on Sundays, where in many districts it remains.

Domestic habits have not altered much in the past fifty years and it is, therefore, reasonable to assume that unless new apparatus is produced and adopted by the majority of the community, load characteristics will not alter considerably in the next ten years.

Generating plant is so urgently needed that the utmost advantage must be obtained from it as it is commissioned. To use it only at peak times does not improve overall efficiency, so necessary when fuel is in short supply, neither is it a sound capital investment.

I would like to correct the erroneous opinion of Mr. Butterworth that time switches cannot cater for week-ends. A standard time switch can be arranged to

provide a different switching programme each day of the week, or omit any day as required.

I agree that the B.E.A. does not favour control entirely by frequency variation and, since my original article was published, research has already produced control apparatus based on a differential between voltage and frequency, or voltage variation and current demand.

Frequency-sensitive relays do, however, appeal as control or warning media as witness correspondence from many parts of the world.

As suggested in my article, I consider it a negative frame of mind which does not seek an early solution to a problem but waits until the effects cannot be handled.

New Malden, Surrey. W. A. DEVON, (Venner Time Switches, Ltd.)

Power from Old Ships

YOUR 31st August issue calls attention to the fact that a good deal has been written recently on the possibilities of obtaining power from old ships, particularly those fitted with turbo-generators for the main drive. It appears to have been overlooked that most vessels of this type, when using their full power, rely on the scoop action from their own forward motion to supply cooling water to the condensers and that the circulating water pumps are normally of sufficient capacity only to provide the cooling water necessary when the ship is stopped.

It is doubtful whether room could be found in the normal engine room of a ship already constructed for the very much larger pumps which would be necessary.

Assuming all this could be done it would not be generally a practical proposition. First of all calm water is necessary as the ship must not strain her shore connections. Secondly, because a ship is designed for moving, the distance between the inlet and outlet is usually comparatively small and unsuitable for use at full power in still water with the ship at rest. Thirdly, although full power trials are carried out in docks, in those ships that are suitably fitted, the trials are of short duration and only the largest docks could stand the continuous discharge of heated water without affecting the vacuum and so reducing the power output. Even in a fast running tideway full power would only be available with tide running from bow to stern, as the outlet is astern of the inlet and with tide from astern short circuiting would occur.

All the above facts, of course, only apply to the use of existing ships and do not rule out the possibility of designing a floating generating station. Even so it would be difficult to find a suitable stretch of water for one to be permanently moored. The lochs of Western Scotland immediately suggest themselves: as this, however, is not where the power is required a new transmission problem immediately arises.

London, W.7. H. LLOYD-WILLIAMS, D.S.O., V.R.D., B.SC.(ENG.), A.M.INST.C.E., M.I.E.E.

Radio Advisory Committee

A JOINT committee has been formed to advise the Councils of the Radio Communication and Electronic Engineering Association, the Radio and Electronic Component Manufacturers' Federation and the Scientific Instrument Manufacturers' Association. Membership of this Joint Advisory Committee on Radio Communication and Radar Measuring Instruments is open to any member of the three Associations concerned with the development or production of this class of instrument.

The committee will consider commercial and technical questions brought to its notice by members, Government Departments and other bodies. This single channel for consultation with Government Departments on matters of common interest should be convenient both to the industry and to the Government.

The committee is administered from the offices of the Radio Communication and Electronic Engineering Association, 59, Russell Square, London, W.C.1 (telephone: Museum 6905) and its secretary is the assistant secretary of the R.C.E.E.A.

Powered Hand Tools

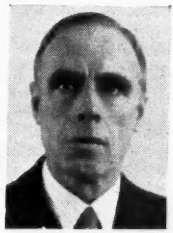
THREE additions to the Ministry of Works "Guides to Good Building" series of advisory leaflets relate to powered hand tools. The first (No. 18 of the series) covers the various electric tools available for woodworking: the saw, plane and woodworker, houser, router and chisel mortiser. Pneumatic and electric tools suitable for all trades are dealt with in the second leaflet (No. 19), which gives hints on operation, maintenance and safety precautions with regard to the drill, hammer, disc and belt sanders, grinder, screwdriver and nut runner. Further instructions on use, maintenance and safety precautions are contained in the third leaflet (No. 20), which also indicates the various jobs for which the individual craftsmen can utilize the various tools. The leaflets, which cost 2d each, are published by H.M. Stationery Office.

PERSONAL and SOCIAL

News of Men and Women of the Industry

UNDER the provisions of Section 6 of the Transport Act, 1947, the Minister of Transport has appointed **Mr. W. H. Powell,** representative of industry, to be a member of the Transport Users' Consultative Committee for the London Area, in succession to the late Mr. E. W. Rainer. Mr. Powell is the executive transport manager of Falk, Stadelmann & Co., Ltd.

Mr. A. Gardner, B.Sc., F.R.S.A., Aberdeen area manager for the North of Scotland Hydro-Electric Board, is retiring on 31st December next. Mr. Gardner joined the Aberdeen Electricity Department thirty-nine years ago as assistant to the development engineer, and later was substation superintendent and development engineer. He was appointed city electrical engineer in 1937 on the retirement of Mr. J. A. Bell.



Mr. A. Gardner

Sir Charles Colston, C.B.E., M.C., D.C.M., chairman and managing director of Hoover, Ltd., opened the British section of the Canadian National Exhibition at Toronto on 23rd August.

Mr. P. Hay, who has been sales engineer and previously senior estimator at the Manchester office of Crompton Parkinson, Ltd. (Plant Division), has relinquished this appointment to become a sales engineer at the Manchester sales office of Lancashire Dynamo & Crypto (Mfg.), Ltd.

At the annual general meeting of the British Institution of Radio Engineers on 26th September the Institution's senior award, the Clerk-Maxwell Premium, will be presented to **Mr. D. W. Heightman** (English Electric Co., Ltd.) for his paper on "The Propagation of Metric Waves beyond Optical Range." Other awards to be presented include the Heinrich Hertz Premium to **Mr. R. Kompfner,** Dipl.Ing. (Clarendon Laboratory, Oxford) for his paper on "The Operation of the Travelling Wave Tube at Low Level"; the Louis Sterling Premium to **Mr. J. E. B. Jacob,** B.Sc. (Cinema Television, Ltd.) for his paper entitled "High Performance Television Monitors"; and the Dr. Norman Partridge Memorial Award to **Mr. S. W. Punnett,** B.Sc. (University College, Southampton) for his paper "Audio Frequency Selective Amplifiers."

Under the auspices of the British Council, **Mr. M. W. Humphrey Davies,** M.Sc., A.M.I.E.E., lecturer at the Imperial College of Science and Technology, **Mr. James R. Mortlock,** Ph.D., B.Sc.(Eng.), M.I.E.E., B.T.H. Co., Willesden, and **Mr. Leslie Gosland,** B.Sc., M.I.E.E., British Electrical and Allied Industries Research Association, are visiting Scandinavia to attend a conference for power system engineers. After visiting Copenhagen (3rd to 6th September) they will be in Norway until 15th September. On his way home Mr. Davies will spend a few days in Sweden, where one or two lecture engagements may be arranged for him.

Mr. J. H. Dawson, assistant engineer at the Carville power station, Wallsend, has won an award from the American Economic Co-operation Administration which will entitle him to a year's study of production, technical and management problems at the Rensselaer Polytechnic Institute, New York. Mr. Dawson's award was one of thirty-five offered by America. He served his apprenticeship with Harrogate Electricity Department, and obtained an honours degree in electrical engineering at Leeds University.

Mr. N. T. Palmer, A.M.I.E.E., assistant district engineer at Chester-le-Street in the Wear Sub-Area of the North Eastern Electricity Board, has been appointed district engineer at South Shields in succession to **Mr. G. H. Dale** who has retired. Mr. Palmer was educated at Nottingham University College and after three years with the British Thomson-Houston Co., Ltd., joined the former North-Eastern Electric Supply Co., Ltd., in 1938. He held various appointments with the company, his most recent being assistant engineer for the Chester-le-Street area.

Mr. C. L. G. Fairfield, M.A., A.M.I.E.E., A.M.I.Mech.E., Barrister-at-Law, has been appointed manager of the Valve Division of Mullard, Ltd. Mr. Fairfield joined the

Mullard organization in 1947. He was previously with the Metropolitan-Vickers Electrical Co., Ltd., the Central Electricity Board and Balfour Beatty, Ltd.

Sir Felix Pole has joined the board of the Pulsometer Engineering Co., Ltd., and becomes chairman in the place of **Mr. Eliot Hodgkin** who has resigned. **Messrs. R. G. W. Bliss** and **A. V. Price** have been appointed directors but will continue their duties as works manager and chief estimator respectively. **Mr. J. Elliott** has been appointed secretary of the company.

Mr. P. W. Cash, B.Sc.(Eng.), A.C.G.I., M.I.E.E., has been appointed technical executive assistant to Sir John Hacking, M.I.E.E., deputy chairman (operations) of the British Electricity Authority. He succeeds Mr. G. R. Peterson, B.A., M.I.E.E., who (as reported in our 3rd August issue) has been appointed generation operation engineer in the chief engineer's department. Mr. Cash was educated at Malvern College and the City and Guilds (Engineering) College. After practical training with the Metropolitan Electric Supply Co., Ltd., he joined the Perak River Hydro-Electric Power Co., Ltd., Malaya, in 1928. He returned to England in 1932 and joined the Central Electricity Board, subsequently becoming operation engineer in the Central England Area. With the establishment of the B.E.A., Mr. Cash returned to London early in 1949 as engineer responsible to the system operation engineer, being concerned with the preparation of generating plant extension programmes and of the 275 kV grid scheme. Later he became special engineering assistant to Mr. V. A. Pask, the chief engineer.

The announcement in last week's issue that **Sir Arthur P. M. Fleming,** while retaining his seat on the board of the Metropolitan-Vickers Electrical Co., Ltd., has relinquished his executive duties as director of research and education in that company, should not be taken to imply even partial retirement. He is in fact undertaking wider responsibilities, having been appointed director of research and education of Associated Electrical Industries, Ltd. Sir Arthur has for some years been chairman of the A.E.I. Research Committee which co-ordinates research activities of the manufacturing companies within the A.E.I. group, and the long-term research of the laboratories at Aldermaston, Berks. In his new capacity he will undertake also the co-ordination of the educational work of the various companies.

Mr. T. H. F. Willoughby, chief accountant of the Marconi International Marine Communication Co., Ltd., and **Mr. S. Stansbridge,** manager of the traffic division, have retired. **Mr. F. H. Reeves,** deputy chief accountant, is appointed chief accountant and **Mr. W. Hill** deputy chief accountant. Mr. Willoughby will continue to act in an advisory capacity until the end of this year, and Mr. Stansbridge's services will still be available for consultation.

Mr. A. C. Hazel, the author of the article on "Domestic Heating" on page 483, is managing director of Hurseal, Ltd., joint managing director of Gulf Radiators, Ltd., and a director of F. W. Cook & Co. (Southampton), Ltd. He is a member of the Institute of Fuel, and has designed and holds patents covering space heating equipment. Before the war, in which he served as a lieutenant-commander, R.N.V.R., he was with the Coal Utilization Joint Council. In 1934, at the age of 23, he won the E.D.A. National Public Speaking Contest.

In view of **Mr. H. L. Kirke's** prolonged absence on sick leave, the B.B.C. has decided to appoint **Mr. F. C. McLean** as acting assistant chief engineer with effect from 1st September. He will take over Mr. Kirke's work of co-ordination and direction of the technical work of Research, Planning and Installation, Designs, and Equipment Departments of the Engineering Division.

Miss S. Keal has been appointed senior demonstrator with British National Electrics, Ltd. Miss Keal began her career in the electrical industry with the Edmundson group of companies, eventually becoming senior housecraft adviser with the Wessex Electricity Co. Until recently she was housecraft adviser with Elexcel, Ltd.

OBITUARY

Mr. L. Champney.—The death occurred at Wimbledon on 28th August of Mr. Laurence Champney, B.Sc.(Eng.), M.I.E.E., a principal scientific officer in the Royal Naval Scientific Service. He was fifty-two years of age.

WILLS

Mr. C. C. Metcalfe, A.M.I.E.E. retired electrical engineer and first electrical engineer to the Manchester Education Committee, left £12,911 gross (£12,596 net).

Col. A. E. Le Rossignol, C.B., M.Inst.C.E., M.I.E.E., former general manager and engineer of the Newcastle-upon-Tyne Corporation Tramways, and consulting engineer to Glasgow Corporation Tramways Department, who died on 21st March last, left £34,891 gross (£27,994 net).

Mr. T. N. Veitch, joint managing director of Hague & McKenzie, Ltd., who died on 16th March last, left £15,342 gross (£11,641 net).

Mr. W. E. Hobbs, late South Wales district manager of the G.E.C., who died on 16th April last, left £27,927 gross (£27,864 net).

I.E.E. Section Chairmen

Some Notes on Their Careers

IN the next few weeks the full programme of meetings of the Institution of Electrical Engineers in London and in the Provinces will be under way. As has been our custom in previous years we are publishing in this and in subsequent issues, biographical notes and the portraits of the chairmen of the specialized Sections and of the various Centres of the Institution. A brief biography of Sir John Hacking, the new President, was published in our issue of 27th July.

MR. A. H. YOUNG, chairman of the Utilization Section, is managing director of Edmundsons Electric Co., Ltd., and a director of its subsidiary companies. Before nationalization of the electricity supply industry, he was commercial manager of Edmundsons Electricity Corporation, Ltd., and a director of thirteen companies in the group. He received his technical training at the Kintyre Technical School, Scotland, and was superintendent of the Electricity Department of the Jamaica Public Service Co., Ltd., before joining Edmundsons. He has served on a number of committees in connection with electricity supply and utilization, and at present he represents the I.E.E. on the Codes of Practice Committee, and is chairman of several of the Drafting Committees.

MR. F. J. LANE, O.B.E., M.Sc., who is chairman of the Measurements Section, was educated at West Leeds High School and Leeds University. He received his technical training first with Crabtree & Sons, Leeds, and then as a student apprentice with the British Thomson-Houston Co., Ltd., at Rugby and Willesden from 1924–27, after which he joined the Yorkshire Electric Power Co. On completion of his training he held an appointment as protective gear engineer with the British Thomson-Houston Co., Ltd., for three years, and in 1934 joined the Central Electricity Board as technical assistant for South-East England. Three years later he was promoted to technical engineer at head office of the C.E.B., with special responsibility for protective gear and for system development in Northern England, and in 1946 was placed in charge of the system development section. On the nationalization of the industry he became transmission design engineer of the British Electricity Authority at headquarters.

MR. D. C. ESPLEY, O.B.E., D.Eng., chairman of the Radio Section, is in charge of telecommunications research in the G.E.C. Research Laboratories at Wembley, and is chief engineer of the G.E.C. Stanmore Laboratories. He graduated B.Eng. from Liverpool University in 1928 with first class honours and joined the Research Laboratories of the G.E.C. at Wembley two years later. In 1934 he was appointed to the leading scientific staff of the laboratories, and in 1940 obtained his doctorate in engineering. He was awarded the O.B.E. in the Birthday Honours of 1950. During the last war Dr. Espley was responsible for the development of several special radar projects, and more recently he has been in charge of the team of specialists who designed, developed and installed the London–Birmingham television radio relay link. For many years Dr. Espley has represented the G.E.C. Research Laboratories at the Conferences of the International Telephone Consultative Committee (C.C.I.F.). He is the author of many publications in the field of telecommunications, and has been awarded the Ambrose Fleming, Duddell and John Hopkinson Premiums of the I.E.E. for papers on this subject.

MR. R. DAVIS, M.Sc., senior principal scientific officer in the National Physical Laboratory, is

Mr. A. H. Young

Mr. F. J. Lane

Dr. D. C. Espley

Mr. R. Davis

chairman of the Supply Section. He graduated in physics at Armstrong College (now King's College), University of Durham, after serving in the 1914–18 war, and following graduation, worked for some months in the Research Laboratories of the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park. He was appointed to the scientific staff of the N.P.L. towards the end of 1924 and has served in the Electricity Division since then, working in the high voltage laboratory since its inception round about 1930. Mr. Davis delivered the I.E.E. Parsons Memorial Lecture in 1945.

Merseyside Breakdown

ON Monday last there was a widespread breakdown of electricity supply in the Merseyside and North Wales area. In Liverpool the stoppage was complete between 5 p.m. and 8 p.m. The tramway system was affected and tramcars blocked the traffic. Loss of power on the Mersey Railway and the Southport and Ormskirk lines caused chaotic conditions at the peak traffic period. The towns affected included also Colwyn Bay, Southport, Blackpool, Wallasey, Birkenhead, St. Helens and Chester.

Mr. P. d' E. Stowell, chief engineer of the Merseyside and North Wales Electricity Board, is reported to have said on Monday that the cause of the breakdown was unknown: in some cases the stoppage was only for a very short period. Parts of the area were disconnected from the grid system and some stations in the area were overloaded and unable to carry on.

Railway Signalling Symbols

SCHEMATIC symbols for use on plans which indicate general railway signalling requirements are set out in Part I of B.S. 376, which is sectionalized into: signals, points, track details, apparatus, controls, level crossings and buildings. These symbols do not show the component parts of the apparatus to be used, but they have been so designed that they may be combined with each other in cases in which a single one does not adequately represent the complete device. Each symbol is identified by a reference number and an alphabetical index is included. Copies may be purchased from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 5s post free.

Engineer Buyers' Guide

THE Engineer Buyers and Representatives Association was founded in 1947 and incorporated in 1948 to raise and establish standards of ethics and competence of those engaged in the marketing and purchase of engineering plant and equipment. The Association has now issued the first edition of its Guide and List of Members. This sets out the memorandum and articles of association, and contains particulars of the services which are made available to members, including a benevolent fund, appointments service, technical advisory panel, and an education scheme. There are also a list of members and their firms, a numerical index of members, and a buyers' guide. The address of the Association is 47, Victoria Street, S.W.1.

Street Lighting at Ledbury

LEDBURY has recently completed a street lighting scheme utilizing 27 fittings mounted on concrete columns and brackets, supplied and erected by the Revo Electric Co. The Midlands Electricity Board was responsible for the planning of the installation. The lanterns employed are Revo "Silverblue" fittings using 250 W horizontally burning mercury vapour discharge lamps. A special feature of this die-cast lantern is the dual reflector system which, together with the patent glass refractor panels, ensures the maximum utilization of all available light and elimination of glare. Revo "Phidias" concrete columns, with brackets of 6ft projection, carry the fittings.

Besides providing an even illumination of the road surface the new street lighting installation at Ledbury shows up to advantage the architectural features of the buildings

Refrigeration Congress

Second Assembly in London

IT was a French idea, supported by the then eight-year-old Cold Storage and Ice Association in London, that resulted in the first Congrès du Froid being held in Paris in 1908. Subsequent congresses were held in Vienna (1910), Chicago (1913), London (1924), Rome (1928), Buenos Aires (1932) and The Hague (1936); and the eighth (29th August to 11th September) is now being held at Church House, Westminster.

The object has from the outset been to assist progress in this branch of engineering by the studies of seven international commissions and the holding of periodical congresses. Thus the many papers by authors from a number of countries being presented in London are grouped in seven sections.

Commission I deals with gas liquefaction, separation, recovery, fractional condensation of mixtures, etc.

Commission II is on thermal conductivity, insulation, moisture penetration, flow of boiling liquids, maintenance of constant temperature and humidity, determination of cooling by measurement of condensed water and frost deposit.

One paper in this group, by B. Bonfolio and L. Dell'orto, recounts the freezing of soil for constructing a tunnel under the deep bed of the Algone torrent in the mountain gorge of the River Sarca.

Another paper in this group, by P. Laine and R. Mock, describes attempts to estimate traces of hydrochloric acid in commercial methyl chloride by measuring its electrical conductivity, which is relatively high. Experiments have shown that this acid is not ionized by methyl chloride, the latter's conductivity being due to ferric chloride which dissolves in appreciable quantities in methyl chloride and is ionized by it.

Commission III is concerned with fundamental biological effects of low temperature on organisms, animal cells, plant tissue, meat, fish, etc.

Commission IV is dealing with testing and safety codes and such machinery as evaporators, chemical regulating devices, condensers, compressors, etc.

A paper in this section, by Cesare Codegone, compares units of measurement and suggests that the time is opportune to adopt the Watt as the international unit of refrigeration capacity. The author expresses a wish that the Congress should pass a resolution to that effect.

Commission V studies the preparation and cold storage of butter, eggs, meat, fruit, thawing of frozen foods, refrigeration in the refining of cheese and fumigation of stores.

Commission VI deals with the transport of frozen foodstuffs in ships and perishable goods in railway cars as well as the handling of such goods.

Commission VII is on general economics, statistics, legislation and so on.

The programme includes visits to plants, inspections of installations and social functions.

B.R.A. Luncheon

Members of the British Refrigeration Association entertained a number of delegates to the Congress at a luncheon held at the Connaught Rooms, London, last Friday. Mr. A. E. Leach, chairman of the B.R.A. Council, presided over a company of about 440 and the principal guest was Mr. A. G. Bottomley, Secretary for Overseas Trade, Board of Trade.

Mr. R. H. Line, a member of the B.R.A. Council, proposed the toast of "The Eighth International Congress of Refrigeration." He said that since the last Congress in London (1924) there had been remarkable developments in refrigeration and the industry owed much to the work of those represented by the International Congress. The introduction of automatic electric refrigeration from the United States in 1926 had enabled tremendous headway to be made in both domestic and commercial refrigeration. Other outstanding developments had been the Freon group of refrigerants and the introduction of the hermetically sealed refrigeration system.

British manufacturers had earned for their industry a finer record of export achievement than any comparable industry

in this country and since the 1924 Congress their output had increased seven times.

In spite of this they were now faced with a lack of steel. The speaker recognized that steel was short but he appealed for a better share and a more generous allocation to the refrigeration industry.

Growth of Export Trade

Mr. Bottomley responded to the toast, explaining that he was deputizing for Sir Hartley Shawcross, President of the Board of Trade, who was resting after his illness. He complimented the industry upon its achievements in the export field. In the first seven months of this year the value of refrigeration plant exports was £7,891,000 against £5,378,000 in the corresponding period of 1950; this increase had meant a great deal of hard work. During the last twelve months import prices had shown a most alarming rise and we would eventually have to adjust prices of our exports: but they could not be put up overnight.

The share-out of steel had to be made with due consideration of defence requirements and those of such essential needs as electric power stations which were closely linked with defence. Subject to this, industries like the refrigeration industry which contributed largely to export trade would receive essential raw materials to the greatest possible extent. It would be wrong to assume that more steel would be available in, say, 1952 because an allocation scheme was being introduced in December. But they hoped that the balance after defence needs had been met would be better distributed.

Sir Norman Kipping, director-general of the Federation of British Industries, in proposing the toast of the British Refrigeration Association, compared those in the refrigeration industry with the craftsmen of the City Guilds. But, he said, they did not conceal their "art and mystery"; they were willing to explain their technique and preserved a high ethical standard. Moreover the Association also did much for education and protected its members against the harsh results of Government action. It was outstandingly progressive and its director (Mr. Batt) gave experienced advice to the F.B.I.

The response was by Mr. E. G. Batt, director and secretary of the Association. The speaker referred to the scope of the membership, the Association's contacts with Government Departments and its contribution to the work of the National College for Heating, Ventilating, Refrigeration and Fan Engineering and said that a very fine laboratory, equipped mainly by members of the B.R.A., was on the point of completion.

Speaking of the industry's progress in the face of difficulties, Mr. Batt said that last year the total production, apart from Government and marine contracts, was over £24½ million of which £10 million was exported to 126 individual territories. To-day this country was second only to the United States as an exporter of refrigeration machinery.

The doubling of the rate of purchase tax on domestic refrigerators in the last Budget had materially reduced the volume of home sales. Export trade had to have a proper foundation of home sales; the more the latter were restricted the more difficult it became to sell in world markets.

Sales Policy

As regarded resale price maintenance, he emphasized that in protecting the interests of those in the refrigeration industry his Association paid due regard to the proper interests of the public. At no time had the Association members had a collective price maintenance scheme and they had no intention of doing so. Each manufacturer fixed his own prices and was required by the Association to sell his goods under a strict guarantee, extending in the case of some equipment over a period of five years.

Further, the distributive side of the industry had to provide service, maintain stocks of spares and equipment and employ properly skilled staff. The continued training and security of employment of technically skilled workers rested in no small measure upon the continuance of the industry's well-proved policy. If resale price maintenance were forbidden or hampered many honest distributors would be forced out of business and the public would inevitably suffer as they would no longer be able to obtain the after-sales service to which they were justly entitled. Mr. Batt hoped that in any future legislation due regard would be given to these considerations.

The chairman's health was proposed by Mr. N. F. T. Saunders (member of Council) and Mr. Leach responded.

Paper Mill Drives

Power Generation and Motor Speed Control

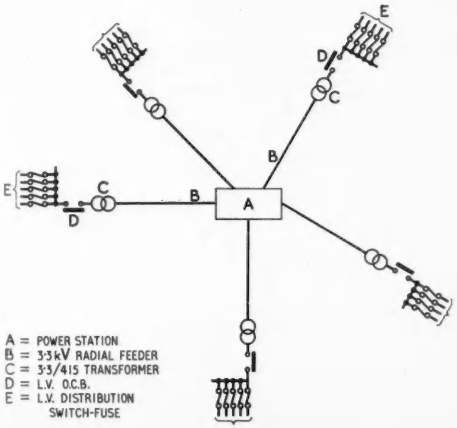
By T. B. SANSOM, A.M.I.MECH.E.

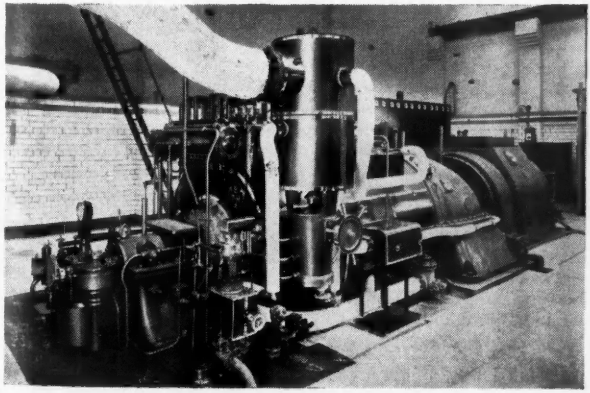
PAPER making depends upon an abundant supply of steam for processing purposes, so that a paper mill is a manufacturing unit that can operate efficiently only when the steam cycle is made to do as much work as possible.

If the steam is conveyed to the mill plant through an intermediary pass-out turbo-generator, electricity may usually be generated more cheaply than it can be purchased from the public supply mains. The method of utilizing electric power privately generated on the premises in this way can affect the overall efficiency of the mill plant, tending ultimately to lower the manufacturing cost of paper. Thus steam engine driven line shafting has been replaced over the years by the Harland electric drive and by the a.c. commutator motor, while electronic means of controlling mill machinery is now being offered by manufacturers.

Relative sizes and rupturing capacities of a.c. switchgear render it inadvisable to generate more than 1,500 kW at less than 3·3 kV or 6·6 kV with possible consideration of 11 kV when the load approaches 5,000 kW.

It may be shown approximately that to distribute an a.c. supply of 3,000 kW at 440 V to essential paper mill services costs £350 a year in voltage drop alone, whereas with generation at 3·3 kV this loss is reduced to something in the order of £40. These figures





Top left: **Fig. 1.—Diagrammatic single radial feeder system for power distribution in paper-making mill**

Left: **Fig. 2.—Typical extraction type turbo-alternator of 5,000 kW at 3,000 r.p.m. in the power house of a paper mill in Scotland** —*B.T.H.*

are based on the average length of cable runs in the paper industry, not on isolated cases of long runs of low voltage cable. The comparison becomes greater as the kW to be distributed becomes larger and the size of the mill increases.

When installing new generating plant in an existing mill it is sometimes impracticable to carry out the above recommendation in detail: for example, the existence of a good low voltage distribution scheme that it would be uneconomical to do away with. In such a case the most suitable arrangement is to generate at the higher voltage and transform down at, say, one or two points into the existing l.v. distribution network. If, however, a new mill is being erected, or the existing l.v. system is in such a condition that it is ready for scrapping, then the ideal is to take the h.v. right into the plant to the nearest points required. Transformation may then be by a number of small individual units, say of the order of 1,000 kW, so as to keep distribution losses to the minimum.

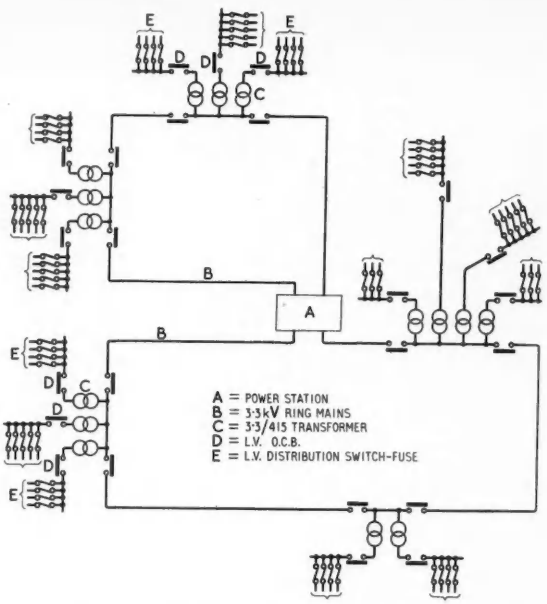


Fig. 3.—Diagrammatic representation of ring main distribution system

The paper making process is continuous and, once started, operates on a six day basis with a 24 hour day. A complete shut down, through a cable or transformer failure, can mean considerable financial loss so must be avoided at any cost; electrical systems are usually designed so that, at the worst, only a partial stoppage can occur for as short a time as possible.

In paper making large quantities of water, steam and acids are used so care must be taken both in the placing and design of electrical equipment to combine reasonable initial cost with reliability, flexibility and economic working. Any scheme of duplicate feeders, whether ring main or radial, tends to become expensive and so it is essential to know where to draw the line. Providing the total power supply can be sectionalized and the cable runs chosen are reasonably straight and free from the effects of steam, water, corrosion and mechanical damage, a single radial system (see Fig. 1) represents good modern practice in respect of reasonable initial cost and economic working. If only cable routes can be chosen which may not be entirely safe and it is not considered worth while to take a chance in order to save £2,000 or so, then a ring main system (Fig. 3) is preferable to the duplicate type of radial feeder network. Paper mill distribution may be summed up as designed to guard against a shut down during the working period and to ensure, in the possible event of such an occurrence, that the plant involved is reduced to the minimum.

Electrification inside the paper mill has meant the use of electric motors of variable speed. Many plants have a.c. commutator motors and the drive is split up into sections (Fig. 4) each having its own variable speed unit. The main features may be summed up as (1) higher efficiency than the Ward-Leonard drive, (2) infinitely fine speed adjustment as compared with rheostats with definite steps, (3) extremely rapid

speed change as compared with the somewhat sluggish response of d.c. motors to field adjustment and (4) the possibility of starting any motor independently without the use of starting resistances simply by moving its brushgear to the minimum speed position.

The application of electrical timing circuits to the already developed features of this form of drive has produced a system whereby an extremely rapid response to speed control is possible without mechanical adjustable-ratio gears. The use of electronic circuits also makes possible the introduction of very powerful anti-hunting features. Essentially (Fig. 5) each section motor (1) has its armature energized from an adjustable voltage generator (2), the generators being driven in one or more groups by a motor (3) taking its input from the mill supply system; if a.c., this motor will usually be a synchronous machine. The field (4) of each motor is energized at a fixed value from a constant voltage exciter (5) connected to one of the motor-generator sets. The speed of each motor is determined by the degree of excitation

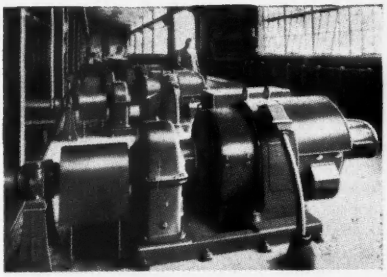
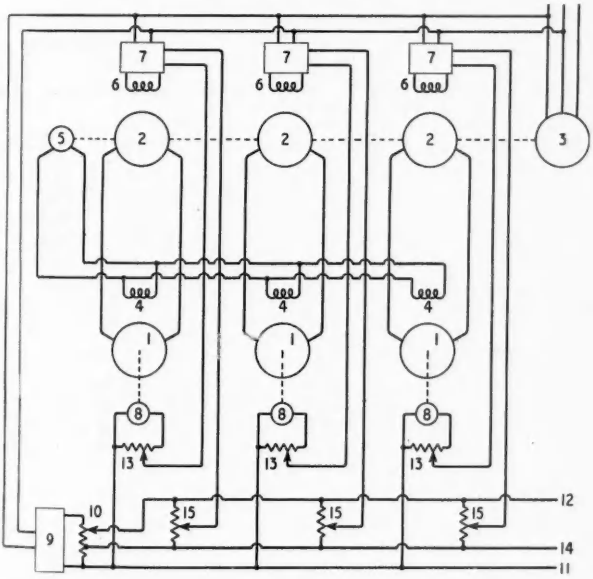


Fig. 4.—Sectional variable speed a.c. drive of machine making greaseproof paper—*B.T.H.*

applied to its particular generator field (6). It can be caused to run at an inching speed by weakening the generator field and it can be brought up to paper-making speed by appropriately strengthening the generator field, so the relative speeds can be adjusted for draw adjustments by correspondingly small regulation of the respective generator fields. Each of the latter (6) is controlled at exactly the correct value by exciting it from an electronic amplifier (7).

Each section motor (1) drives a small d.c. tacho-generator (8) which produces a voltage proportional to its speed. An adjustable reference voltage common to all sections is supplied to lines (11) and (12) from a potentiometer (10) that is fed through an electronic rectifier and voltage stabilizer (9) from the a.c. power supply system. The voltage produced by the tacho-generator on each section motor is compared with the voltage supplied to the lines (11) and (12) while any discrepancy between the two voltages is magnified through the electronic amplifier (7) to produce a corresponding adjustment of the field (6) of generator (2) in such a direction as to maintain the correct speed. The speeds

Fig. 5.—Simplified diagram of connections for sectional a.c. variable speed drive



of all section motors are thus automatically maintained in predetermined relationship to the voltage applied to the lines (11) and (12) and the speed of the paper machine as a whole can accordingly be adjusted by movement of the slider of the potentiometer (10).

An important feature of electronic speed control is that it is possible to obtain a very rapid response, both to changes in condition and to adjustment of draw, without risk of instability. A further advantage is that the belt and cone pulley drive (or other form of adjustable ratio gear) which is a feature of other types of sectional drive is dispensed with in this case.

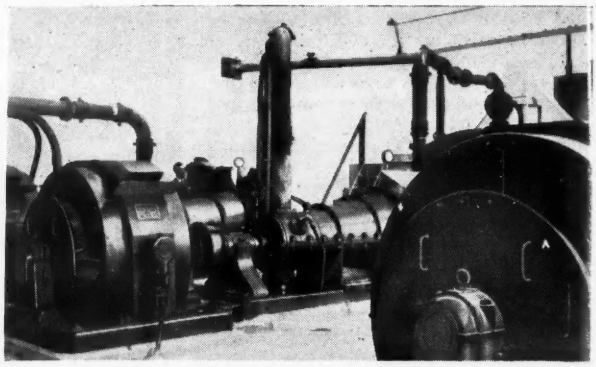


Fig. 6.—Squirrel cage induction motors of 200 h.p. at 3·3 kV and 243 r.p.m. driving refiners in paper-making mill—*Bruce Peebles*

The choice between a fully electronic scheme (such as the B.T.H. method outlined) and the use of electrically controlled generators is largely a matter of economics. It is anticipated that the principal employment of the former will be for special machines having a large number of sections, each requiring a moderate amount of power.

The introduction of the refiner into paper making in the place of the beater has called for a drive of the order of 200 h.p. (Fig. 6) and motors of this rating can be manufactured for direct operation at 3·3 kV, which is one of the reasons for adopting this generation voltage for paper mill work. High voltage motors are slightly less efficient than l.v. equivalents, but this loss is more than offset by the avoidance of transformation losses. There are quite a number of such drives in the modern paper mill; the motors are usually of drip- and splash-proof construction with a squirrel cage winding. The particular one shown (Fig. 6) is designed to start against full load torque with approximately $4\frac{1}{2}$ times full load current and it will run up to its speed of 243 r.p.m. in 2·6 seconds.

There is considerable scope for the high voltage motor of more than 150 h.p. within the paper industry because the internal voltage is chosen to suit the specific requirements of the mill, not dictated by the public supply, which is usually brought in at 22 or 11 kV and stepped down to 415 V for normal industrial requirements. Paper mill auxiliaries usually need motors of 50 h.p. downward to drive fans, pumps, hoists, boiler feed pumps and the turbine auxiliaries.

The industry has tried to standardize on direct-on-line motors of the totally enclosed fan-cooled type, which is a wise move from the points of view both of minimizing electrical controls and the men who have to operate the auxiliaries; many of the employees are totally unskilled and cannot be expected readily to understand the more complicated ways of starting electrical apparatus.

However, at week-ends and when starting the mill turbine after a shut down it is necessary to utilize the standby supply from the public mains, in which cases objection may be taken by an Area Board to the direct-on switching of motors of 50 h.p. and over. Therefore it may be necessary to install some form of auto-transformer starting, or use slip-ring motors, for feed and circulating water pumps as well as any other mill services that require to be operated when the turbine is not in normal service.

Paper making is an industry in which electricity has played a big part during recent years. It has done away with unfavourable working conditions and increased the operating efficiency of the plant as a whole.

Domestic Heating

Tariff Inducement for Continuous Background Warming

By A. C. HAZEL*

ALMOST every day we are reminded in one way or another of the fuel problems which beset this country. Sir Henry Self, in his presidential address to the third British Electrical Power Convention, drew attention to the difficulty of solving the winter power peak and the appointment by the Minister of Fuel and Power of a Fuel Policy Committee to investigate the wider aspects of National Fuel Policy is evidence of the importance and urgency of the situation. So far as domestic heating systems are concerned we all know that the supply of electricity must, for a time, be circumscribed, but the tendency to condemn the use of it at all for certain purposes is unrealistic. The real answer may be a combination of two or more available sources of power, such as smokeless solid fuel and electricity, or smokeless solid fuel and gas as well as electricity, and so on.

This matter is particularly important because the Committee has been asked to consider whether electricity should be used for domestic, office and factory heating; whether gas should be used for lighting and what are the true costs, including capital costs, of the fuels in use for various purposes.

The inference is that electricity may not be suitable for domestic, office and factory heating and that gas may not be suitable for lighting. The electricity supply industry must make up its mind about the value of electrical space heating to the national load and at the same time reconcile itself that this factor must lead to winter peaks even though ultimately the latter are not of more than one hour's duration.

Load Factor Improvement

It is doubtful if the value of the space and water heating loads from the point of view of improving the national load factor is generally realized, but it must be obvious that in a country operating a 5-day working week of 8½-hour days any improvement of the national load factor must come from the domestic market.

Once the present power station building programme is complete and we have capacity sufficient for normal needs, the main need will once again be to sell electricity " off peak " to improve the national load factor. The second requirement will be to ensure that members of the long-suffering British public no longer have to put up with power cuts.

Both of these problems can be solved by the development of space warming and water heating appliances having a thermal carry-over sufficient to cover the peak period, which it is generally agreed will not be more than an hour, in the not too distant future, while at the same time allowing other fuels to take the major part of this load.

Changed Circumstances

Many years ago some electrical engineers advocated the all-electric house. Others recommended the use of electricity exclusively for the heating of water, but circumstances have since modified ideas and most electrical engineers live in homes in which the open fire is still used. Tens of thousands of people heat their water in winter by smokeless solid fuel in domestic boilers, but in summer they switch over to their immersion heaters. Others use immersion heaters to " top up " their existing water heating arrangements.

The chief factor in providing home comfort is to take and keep the chill out of the house by some form of continuous heating, which it is relatively easy to " top up " as and when required; once the chill has been " taken off " it is comparatively simple and inexpensive to keep the house warm. Nevertheless, it is invariably both difficult and costly to deal with the initial warming-up period. The problem

*Managing director, Hurseal, Ltd.

therefore is to select the fuel most suitable for " taking the chill off."

It is doubtful whether we shall achieve overall efficiencies of more than 35 per cent in the use of electricity for space heating, but to-day efficiencies approach 80 per cent where smokeless solid fuel is used in domestic boilers and the hot water so produced is used for central heating. It follows that perhaps the most efficient thing to do is follow that part of the recommendations of the Simon Committee's report which advocated smokeless solid fuel for the main winter space and water heating, with electricity to supplement, but not " top up," the load.

Domestic Boiler Installation

There is no suggestion that electricity should be used to cover cold spells only. Thus, in a middle-class home, a domestic boiler might be used for heating water in winter for baths, washing clothes, dishes, etc. The same boiler, which should be rated at about 45,000–50,000 B.Th.U./hr, would also heat, say, four radiators to provide sufficient warmth to " take the chill off " and maintain the main living rooms of the house at a reasonable temperature throughout the winter. This boiler should be placed in such a position that the heat emitted is usefully retained in the living spaces.

A boiler of this heating capacity is not too large to go into the ordinary kitchen, or in a living room, which might be better described as a utility room. The design can be kept within the standard dimensions for kitchen equipment, namely, 36 by 21in. Furthermore, the amount of attention a boiler of this size would require would not be more than re-fuelling twice a day. In the case of one boiler on the market to-day the ash-pan needs emptying only once a week, or possibly once a fortnight in mild weather.

There is no need for an outside boiler house and " outside flue " to accommodate a large unsightly boiler. The high-efficiency domestic boiler can be fitted on an inside wall and the flue used to heat the walls of the kitchen and rooms adjoining the flue. Finally, the flue can keep the cold water tanks in the roof warm as well as warming one wall of the airing cupboard. The hot water cylinder and pipes can be thoroughly and efficiently lagged as enough heat is emitted from the wall of the chimney flue for airing clothes.

A boiler rated at 50,000 B.Th.U./hr is of a size that can operate efficiently whether on the hot water load only, or both hot water and partial central heating, whereas a boiler big enough to provide complete central heating throughout the house with, say, ten radiators would operate at a lower efficiency when on hot water supply only.

The hot water radiators can be placed in the main downstairs living rooms and, if the boiler is thermostatically controlled, the temperature in these rooms can easily be maintained at 65 deg F. A smokeless fuel open fire can be used for its attractive appearance and " topping up " while, if the living room is unduly large, thermostatically controlled electric " oil-filled " radiators with a high thermal carry-over might also be installed.

In the principal bedrooms, nurseries and any rooms not regularly used, thermostatically controlled " oil-filled " electric radiators can be installed which are totally enclosed and therefore perfectly safe, a most important feature. They need not be switched on until after the evening peak and they will be switched off before the morning peak. Moreover, the temperature required in these rooms would be only about 55 deg F instead of the 65 deg F provided by the boiler. The use of load controlling devices, such as ripple relays or time switches, under the Electricity Board's seal, for heaters of this kind would prevent misuse.

However, it must be borne in mind that in a house in which the chill has been taken off by hot water radiators, the walls retain some heat and the thermal carry-over of electric " oil-filled " radiators in a well insulated house can be anything up to an hour. In other words radiators of this type might well be used continuously, if need be under load control, being switched off only during the period of the peak, which in present circumstances would be on the predetermined day of the week advertised by the Electricity Board, without any undue inconvenience to the occupants.

Wide Diversity Possible

From the long-term angle, " switch-off-switch-on " control covering all domestic power appliances and therefore space heating in particular, can be used in a way that will cause wide diversity between the incidence of loads under such control. In other words, it should be possible for

" switch-off-switch-on " control in one town to remove the domestic power load for, say, the first hour and then for the second hour in another town and so on. Thus by the judicious use of controlling devices a remarkably high load factor, coupled with a very good diversity factor, should be obtainable. It would mean, of course, that the instantaneous electric space heater with an exposed element, commonly known as the electric fire, would become unpopular, which might be all to the good, for the tendency would be to go over to space heating appliances with a thermal carry-over of anything up to an hour which can be switched off without inconvenience. This would undoubtedly mean thermal storage electric water heaters and oil- or sand-filled radiators.

If load controlling devices were used on the sort of scale suggested above it would be necessary to revise the present method of charging for electricity and to go back from the two-part tariff to a high kWh charge for electricity for lighting, which is the main cause of the evening peak due to overlapping the factory load, but consumers using electricity under " switch-off-switch-on " control would expect to purchase their electricity at appropriately attractive rates.

The whole point is that lighting, which cannot possibly be switched off under load control without causing danger and an enormous amount of inconvenience—in fact a breakdown of the life of the nation if it should happen during the hours of darkness—would be safeguarded and because of this assurance the consumer should pay its correct proportionate cost. In other words, the standing charges for electricity generation should be borne largely by the lighting load.

Smaller Dwellings

The tendency to-day—more so perhaps to-morrow—in Council houses will be to install at least one hot water radiator in the hall, but preferably in the living room, in many cases to be served by a fire-back boiler. More local authorities are insulating the houses they build, though there is still room for a great deal more improvement. Thus the use of electricity for continuous supplementary space heating under thermostatic and " switch-off-switch-on " control might well be developed, even in smaller homes in certain cases without any disadvantage to the national fuel economy and with every advantage to the national load factor.

The desire to damn electricity for space heating regardless of circumstances is largely the result of the purchase of millions of electric fires, which many claim are switched on more or less at the same time on cold mornings and evenings and therefore create those sharp load peaks which many people believe will exist for years unless load controlling devices are used. Also there has been considerable criticism of radiant electric fires on the score of safety, especially now that completely safe electric heating appliances are available. A new draft British Standard is an endeavour to cover this difficulty, but it is envisaged that additional requirements may be necessary for the protection of young children and aged and infirm people.

Risk of Burns

In a recent article* Leonard Colebrook, M.B.(Lond.), F.R.C.O.G., F.R.S., formerly director of the Medical Research Council Burns Unit, Birmingham Accident Hospital, and his wife emphasize the gravity of the danger of electric fires as a source of burns (often fatal). They say that although there are no data about the number of accidents throughout the country caused by electric and gas fires in recent years, their experience in Birmingham during 1945–48 leads them to the conclusion that the figure for England and Wales in each of those years is likely to have been at least 1,400, with nearly 250 deaths. The true figures may well have been considerably higher.

The answer seems to be to develop totally enclosed electric space heating appliances of low surface temperature. Perhaps the best example to-day is the " oil-filled " radiator which is constructed of heavy gauge steel and totally enclosed, therefore completely safe, designed as a fixture to the wall or floor. Movable models are on castors or have a loading of only 500 W.

Where a modicum of central heating by smokeless solid fuel is used, particularly where " oil-filled " radiators are installed for keeping the house warm overnight, the tendency to switch on the electric fire at breakfast time is completely nullified because householders wake up in warm rooms.

Lancet, 30th July, 1949.

It must also be remembered that unquestionably a properly designed open fire combining radiation and convection together with some means of controlling the number of air changes, preferably burning smokeless solid fuel, must carry the heaviest heating load for many years to come. Nevertheless the open fire cannot solve the morning heat problem. Open fires, if they are not to consume more solid fuel than they do at the moment, will undoubtedly be lit probably by a gas poker at about 4 p.m. and remain alight until the occupants of the house retire. They will fulfil the functions not only of warming the living room and helping to keep the chill off the home, but also provide essential comfort and make a cheerful appeal.

However, one has still to heat the room in which breakfast is to be taken, which in many houses is now the kitchen. The latter usually receives a certain amount of warmth from the gas cooker, but a domestic boiler installation is the complete answer because it emits sufficient warmth for reasonable comfort.

Commercial premises might be preheated under control, which would bring the space heaters in at, say, 5.30 a.m. and switch them off during the morning peak.

The author wishes to emphasize that there is no suggestion in this article that electricity can take on the total heating load of this country, at any rate in the foreseeable future. In his opinion the electricity supply industry should concentrate its efforts on filling in the very obvious valleys which are bound to exist even when the present large-scale generation station building programme is completed.

Heat Insulation

It so happens that the author has a home that is fully insulated, in which the doors are fitted with rising hinges and draught preventers, and the heating is by means of a 45,000 B.Th.U./hr boiler with electric " oil-filled " radiators in the bedrooms. Though he owns two modern radiant electric fires, they have never been used since the installation of a combined central heating system using smokeless fuel and electricity. It is his proud boast that he never causes the Area Board the slightest inconvenience by his use of electricity.

Some may argue that the cost of continuous heating with a combination of electricity and smokeless solid fuel is excessive in existing poorly insulated homes. One important fact emerged from the Abbots Langley heating experiments*: it is that the householder uses only the heat he thinks he can afford, though it is true to say that as one's appreciation of heat comfort increases one is prepared to pay a little more for it, and perhaps economize in other directions.

In the case of the middle class market, which is only a small proportion of the total market, it is possible to provide comfortable conditions day and night and during the winter with a fuel consumption of 1½ cwt of smokeless solid fuel and an electricity bill (when electricity is used for a refrigerator, including a deep-freeze, washing machine, table ironer, part cooking, electric circulator and many small appliances) of under 15s a week in winter where the running charge is 1d/kWh.

Electricity Tariffs

It will, of course, be argued that a fuel bill of over £1 a week is beyond the reach of countless millions, but it is surely possible, where electricity is taken mostly under " switch-off-switch-on " control, for the running charge to be only ⅝d or ¾d/kWh, though the lighting charge will be very much higher. The cost of the load controlling device could be charged to the consumer in, say, four quarterly payments. The argument is that the consumer would enjoy a lower tariff as the result and therefore could probably be persuaded to pay for, or rent, the load controller. Incidentally, the change over to control could be gradual and the idea could be sold to the public on the score of a more economical tariff†. At a later stage one could persuade more of the public to go over to " switch-off-switch-on " control by manipulating the tariffs. Manufacturers of space and water heating appliances could also help in selling the idea to the public.

In a low-income home, such as a Council house, one can only visualize in the foreseeable future the use of a small domestic boiler in the kitchen with perhaps only two radiators to take the chill off the most important rooms, which will be well insulated. In such an example a very good case could be made for electric space heating in the principal bedroom and/or

*_Electrical Review_, 18th March, 1949, p. 433.

†" Heating Load, " _Electrical Review_, 31st August, 1951, p. 412.

the children's bedroom, under control, providing the tariffs were sufficiently attractive. That would mean the children could do their school homework in the bedroom and we should be reaching a stage at which more than one room in the house would be habitable during the winter months, without incurring undue expense, which would surely be a lead to happier home environment and worth considerable national effort.

Most people in this country put up with heating conditions which are a disgrace to the civilized world. They get up in the morning and shiver in their bedrooms as they dress. They freeze in the bathrooms as they shave and they go down to eat breakfast huddled over a gas or electric fire. Children are forced to do homework in one living room inhabited by the whole family because it is the only warm room in the house.

The essential feature of the British way of life is the British home and there can be no doubt that the one thing that turns a house into a home in winter is warmth and comfort. The essential thing to do is to educate the public to the virtues of continuous heating in general and background heating in particular. The result could be a happier, healthier and more contented nation. Electricity is making life easier for everyone. It can also play an important part in making life warmer without upsetting the national fuel economy, provided there is proper co-operation between the various domestic fuel producers.

All that is necessary to put the suggestions made above into force immediately is a suitable tariff to encourage the public to agree to have their installations load- or time-controlled, leaving the consumer to pay for, or rent, a control device and the additional meter. There is also a good case for the removal of purchase tax on space and water heating equipment with a thermal carry-over suitable for use in these installations. A start might be made with space and water heating appliances operating under control on night load only. The rest can be left to the manufacturers and the public.

From the national angle off-peak space and water heating would slowly develop to the advantage of the national load factor. We must fill in the valleys as we solve the peaks. The public would gain in increased convenience and economy. The country would gain by having a happier and healthier population.

Raw Material Prospects

A SURVEY of the prospects in the supply of raw materials appears in the *Board of Trade Journal* of 1st September. As regards aluminium it is said that the increase of 2,000 tons a month in allocations to fabricators of wrought metal should enable them to meet increased defence demands without encroaching upon essential civilian orders.

In the case of copper the same consumption levels are being enforced as reported in February last; allocations to first-line users are at the rate of 85 per cent of the average monthly consumption in the first half of 1950. Improvement in supplies depends on the possibility of solving the problem of increasing supplies of Southern Rhodesian coal. The International Materials Conference in Washington is considering the copper position and allocations by the Conference for the fourth quarter are a possibility.

Lead supplies should be adequate to maintain the present level of delivery to consumers this year and next if there are no more shipping difficulties and further restrictions on consumers are unlikely to be necessary.

The zinc position remains serious. Alterations in the level of allocation to consumers are not likely during the rest of this year and the cuts of between 20 and 50 per cent will have to continue. Next year, it is said, there may be a continuation of the progressive improvement which has characterized deliveries to consumers this year but the satisfaction of all demands is not yet in sight.

The acute shortage of tungsten and molybdenum should be somewhat alleviated by the allocations announced at the beginning of July by the International Materials Conference. The uncertainty about supplies of nickel continues; there are hopes of an I.M.C. allocation in 1952 but the situation is expected to remain difficult.

Sulphur allocations have eased the grave situation which existed earlier in the year; the I.M.C. Sulphur Committee proposes to recommend firm allocations for the fourth quarter of the year by 10th September. There is in general no difficulty in obtaining supplies of natural rubber, although prices are still high. Supplies of special purpose synthetic rubbers from the United States and Canada are likely to continue to be restricted.

Gas-Pressure Cable

Portable Leak-Finding Equipment

By L. A. DAUNCEY, B.SC.*

A MODERN feature of high-voltage power transmission is the growing use of gas-pressure cable, in which the insulation between the conductor and the sheath is augmented by a filling of dry compressed inert gas retained within the sheath. Nitrogen gas at a pressure of 200 lb/sq in is generally used for this purpose.

Any proper consideration of the manufacture, installation and maintenance of such cables would be incomplete without taking into account the possibility that occasional leaks may be experienced. For this reason the Pirelli-General Cable Works, Ltd., of Eastleigh, desired the development of equipment that would assist in the tracing of gas leakage from gas-pressure cable, should it occur. Portable apparatus† for this purpose has recently been developed and constructed at the Research Laboratories of the General Electric Co., Ltd., at Wembley and tested both at the laboratories and at the Eastleigh works.

It was assumed that the cable would be installed in sections with occasional stop joints and gas feeding points, but that access could not be expected between those points since the cable would be drawn into ducts or buried in trenches. Any method that relied on " labelling " the leaking gas in some way and then detecting it by exploring along the outside of the cable had therefore to be rejected in favour of one which could be applied from the filling points at the ends of the leaky section. A further assumption was that the leak would be revealed, in the first place, by loss of gas pressure or the consumption by the cable of reserve gas. By finding the two adjacent stop joints between which gas is being lost, therefore, the leak can be traced to a particular section of the cable.

A very large leak which will require the immediate withdrawal of the cable from service is generally the result of some local accident, such as the misplacing of a workman's pick, which leaves no doubt about the point at which repair is needed. The equipment here described is mainly intended to reveal the smaller leaks whose occurrence will probably permit the cable to be kept in service by making up the loss from a reserve of gas until the length in question can be repaired at a convenient time.

Fig. 1.—Representation of length of cable with gas leak

The method employs the differences between the rates of effusion through a leak of different gases at constant pressure. Nitrogen was chosen as one gas, for obvious reasons, and hydrogen was the preferred choice for the other. The range of gases from which the second choice can be made is, in fact, very restricted since considerable differences from nitrogen are required both in density and viscosity. These two properties are of particular importance: the first when the leak behaves as a diffusion membrane, or orifice plate; the second when the leak behaves as a capillary tube. In addition, the test gas must be harmless to the components of the cable and relatively insoluble in both the solid dielectric and its impregnating oil, so that it can easily be removed after a test. The combination of these requirements eliminates such easily accessible gases as carbon dioxide, sulphur dioxide, or ammonia.

The principle of the method can be simply described by reference to Fig. 1 in which AB represents the section of cable with the leak at L. The pressure of the

† British Patent No. 608331.

* Research Laboratories of the General Electric Co., Ltd., Wembley, England.

gas in the cable can be maintained constant if nitrogen is fed in at A at the same rate as it escapes at L. If now the gas injected at A is changed to hydrogen, while still retaining the same pressure in the cable, there will not be any immediate change in the conditions at the leak. The rate of supply of hydrogen will therefore be equal to that of the nitrogen which it replaces, and this condition will persist until the hydrogen-nitrogen interface has moved down the cable and reached the leak. The escape of hydrogen through the leak itself will then however be faster than that of nitrogen, so that an increase of the hydrogen flow will be necessary if the original pressure is still to be maintained. A gas flow indicator at the feed-point A will therefore show in terms of an increased reading exactly when the interface reaches the leak. The volume of hydrogen supplied to the cable between the time it is first injected and the time at which it reaches the leak is equal to the internal capacity of the cable length AL. Hence, from a measurement of this volume and the knowledge of the volume of a unit length of cable, the distance AL can be determined.

Preliminary tests showed that this principle gave excellent results, but its application in the apparatus has been slightly modified to avoid some practical difficulties. The major one is in the measurement of the actual gas flow, the extent of which is determined in practice by the size of the leak. Since control over this factor cannot be effected, the flow meter must be capable of accurate operation over the entire range of expected rates of flow. Such a performance is difficult to achieve in practice so that a ratio method, for which a simpler instrument suffices, is used. In the modified method the main purpose of the flow indicator is to detect the change of feed rate which occurs when the interface between the two gases reaches the leak. The indicator also has to show that the conditions in the cable are steady before testing is started, that leaks do not exist in the apparatus itself, or in the connections between it and the cable. None of these secondary functions, however, requires that the indicator be calibrated in known units of volume.

The apparatus is first connected to one end of the cable (say at A in Fig. 1) and the time required for the gas interface to travel along AL is measured. The test is then

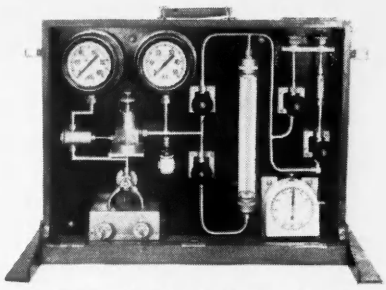
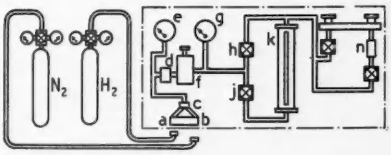


Fig. 2.—Portable leak-finding equipment in carrying case

Fig. 3.—Diagrammatic layout of leak-finding equipment



repeated under the same conditions from the other end (B) of the cable and a second time interval, relating to the length BL, is recorded. Since the internal dimensions of the cable are uniform along the entire length AB, the two time intervals obtained in this way are in the ratio of the lengths AL to BL. The exact position of L can therefore be calculated from a knowledge of the length AB; knowledge of the specific internal volume of the cable is not necessary, so that application of the method is not confined to cables of known internal construction.

In the apparatus (Figs. 2 and 3) cylinders of nitrogen and hydrogen, equipped with reducing valves, are coupled by hoses to the inlet nipples (*a*) and (*b*). The gas, selected by the changeover valve (*c*), passes through a filter (*d*) to the precision pressure regulator (*f*). Gauges (*e*) and (*g*) indicate the supply and controlled pressures respectively. The gas flow is split by the flow-dividing valves (*h*) and (*j*) which are used to control the sensitivity of the flow indicator (*k*). The gas may then be passed either to a test outlet or through the non-return valve (*n*) to the cable feed-point.

The flow indicator* is of the type in

*Rotameter Manufacturing Co., Ltd.

which a light conical " float " is supported and rotated by the gas flow in a vertical tapered glass tube. In this type of instrument the pressure drop is nearly independent of the flow; hence the two flow-dividing valves are required, in place of a simple by-pass arrangement, to adjust the sensitivity of the indicator.

The most convenient procedure for carrying out the tests is first to reduce the pressure in the cable length to about 15 lb/sq in gauge. Nitrogen is fed to the cable through the apparatus and the pressure regulator is set so that the pressure is maintained constant at the required value. The flow indicator is used to determine when the feed rate becomes steady. The changeover valve is then operated and the timing is started. As the response of the flow indicator is lower with hydrogen than with nitrogen, some adjustment of the sensitivity may be needed. The indicator readings are recorded at regular intervals until, after a period of steady values, they rise to a new steady level. The apparatus is then transported to the other end of the length of cable and a second similar experiment is made.

A typical pair of curves connecting indicator readings with time is shown in Fig. 4. The times are measured to the points on the curves at which half the rise in flow indication has occurred. These curves were obtained in a test on a coil of $\frac{3}{8}$in bore tubing 145ft long. The leak in this sample was of such a size that it passed 0·7 cu ft of free nitrogen an hour when the excess pressure in the tube was one atmosphere. The actual position of the leak was 25·5ft from one end; the distance determined by the equipment was 26·5ft. This small discrepancy was due to the fact that the calculation did not take into account the volume of the apparatus, which behaves as an additional length at each end of the cable. While this quantity is usually small enough to be ignored, a correction can be applied to allow for it and the calculated position of the leak will then be within 1 per cent of the actual figure.

The time taken for a test to be carried out is almost entirely determined by the size of the leak and the internal volume of the cable. Working at an increased pressure contributes little towards shortening the test period for, while the amount of gas expelled through the leak is increased, the amount in the cable which has to pass through the leak increases also. High pressures therefore lead to greater gas consumption without any corresponding advantage. It can in fact be shown that when the excess pressure in the cable is of the order of one atmosphere, the time taken for the test, and the errors introduced by small fluctuation in test pressure, are the minimum.

Under circumstances in which it may be important to reduce the testing time some saving can be effected by reversing the usual procedure. That is to say, the cable is first filled with hydrogen and nitrogen is used as the test gas. This has the effect of roughly halving the times to be measured, but the saving is offset by the need for making the preliminary filling with hydrogen.

While the apparatus was primarily designed and constructed for work on cables, it may obviously be used with all other kinds of pipe or conduit in which conditions are suitable. Its use will naturally be subject to some limitations and it cannot be expected to perform well if the leak is so large that either its resistance to gas flow is small compared with that of the cable or pipe itself, or the apparatus cannot maintain the gas pressure. The measurement may also be affected adversely if the internal

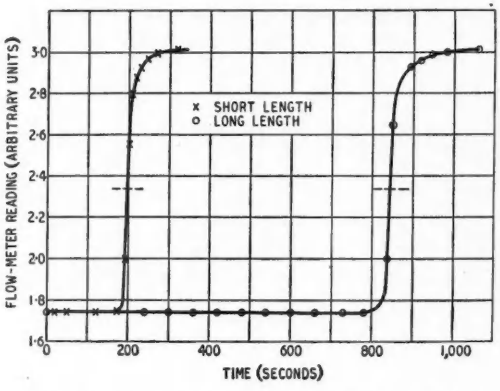


Fig. 4.—Graphs of indicator readings plotted against time

construction of the cable is such that excessive intermingling of the nitrogen and hydrogen takes place.

The accuracy of the result is independent of the size of the leak within quite wide limits. For example, in further tests with the coil of $\frac{3}{8}$in tube referred to above, the leak was adjusted so that the measured times (for the longer section of the length) varied from about five minutes to two hours. The results for the length ratios were all quite consistent and there was no indication that either limit of leakage rate was being approached.

Equipment for Canada

Progress of Approval Scheme

IT will be recalled that early last year, following upon the work of a United Kingdom Electrical Exports Standards Mission which visited Canada in 1949, under the auspices of the British Standards Institution, arrangements were made whereby electrical manufacturers desirous of supplying their equipment to Canada were able to secure, in London, preliminary certification that the equipment conformed to Canadian requirements.

The conditions under which electrical equipment is used in Canada are different from those obtaining in the United Kingdom and thus equipment designed for use in this country may not necessarily be suitable for Canadian conditions, particularly with regard to electrical clearances to earth and between phases.

The procedure in Canada in connection with approval of a piece of electrical equipment is to identify it by means of descriptions sometimes accompanied by illustrations of the important parts; full compliance with the Canadian Electrical Code is assured by carrying out the tests specified, normally at the Canadian Standards Association Laboratories in Toronto. Similar procedure has now been adopted in the United Kingdom, except that the tests are carried out either in the manufacturers' works or by an independent test house. Important tests in works are always observed by a B.S.I. engineer specially conversant with C.S.A. practice, but for other tests and in appropriate cases, test certificates are accepted from the manufacturers, these certificates being countersigned by a responsible member of the firm with the approval of the B.S.I. engineer during his visit to the works.

A report on the equipment concerned is compiled (including identifying descriptions and the results of tests) and this report is sent to the C.S.A. Laboratories in Toronto. After confirmation there, the report is recommended to the C.S.A. Approvals Council. Thereafter the applicant is informed, through the British Standards Institution, that provisionally he may use an Approval Number.

There are at present some 80 individual Canadian approval specifications to cover all types of equipment. Where the apparatus cannot be covered by an individual specification it is necessary to apply the relevant parts of other specifications, and the knowledge of which to apply can be obtained only by experience; furthermore, there must necessarily be a delay between the introduction of new types of equipment and the preparation of an approval specification to cover them, and it has therefore been necessary in certain cases to check with the C.S.A. Laboratories in Toronto regarding details of any unpublished special requirements introduced to supplement the specifications. In this way a large amount of information is being collected in the United Kingdom and as this grows it will obviously be necessary to refer to Canada less frequently.

Applications Handled

Since the inception of the organization about 270 applications for approval have been received. It has been found possible to deal completely with over 80 per cent of these in the United Kingdom; the remainder have been sent on to the C.S.A. Laboratories in Toronto for test. The

few applications which are referred to Toronto are handled in that way mainly when it is thought that approval can be obtained more rapidly, chiefly in those circumstances when lack of information would otherwise render necessary considerable correspondence between the London office and Toronto. In any case the whole of the financial transaction is carried out through the B.S.I. and assistance is still given to the manufacturer by the passing of the correspondence through the London office.

As an indication of the range of equipment covered, approvals have been received for cable, domestic accessories and appliances, industrial switch and control gear, machine tools, motors, welding equipment, food-preparing machines, office machinery, fans and other allied equipment.

The B.S.I. has prepared a complete classified list of United Kingdom equipment which has received C.S.A. approval to date. Those interested may obtain details on application to the B.S.I./C.S.A. Approvals Division, 24/30, Gillingham Street, London, S.W.1.

Heating Liquid Chocolate

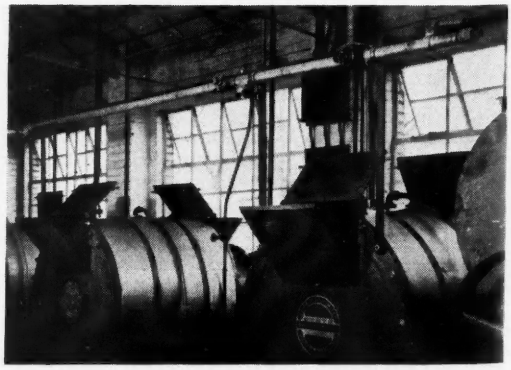
Unusual Method Adopted at Wood Green Works

A PUMPING system has recently been installed in the Wood Green works of the British Couverture Co., Ltd., for the conveyance of liquid chocolate from one part of the factory to another. The heating of the pipe-line was carefully considered and various methods such as steam tracers or hot water jackets were suggested. Eventually a more modern and hygienic arrangement was put forward and developed with the help of the Wood Green District of the Eastern Electricity Board, who carried out experiments based on the use of the pipe-line, including the necessary fittings and valves, as part of an electrical circuit, which by virtue of its resistance would heat up to a given temperature. This was eventually fixed at 110 deg F.

The installation consists of a small transformer with a 240 V primary, designed to give a continuous output of 14 V at 230 A, which is connected across the ends of 148ft of 2in standard steam barrel. Lugs were welded on to the pipe to make satisfactory connections between the feeding v.i.r. cables and the pipe and particular care was taken during the erection to see that all the barrel joints were cleaned before tightening, to avoid localized heating. A pipe thermostat, which controls the primary of the transformer through a one-to-one ratio transformer, keeps the temperature constant. The purpose of this transformer is to prevent a supply with earthed neutral being brought into contact with the pipe run. The pipe circuit is not earthed and is insulated from its metal supports by leather cushions between the pipe and the saddles. An additional precaution is an earthed screen between the primary and secondary windings of the transformer.

The installation is designed to heat from room temperature to 110 deg F in 30 min and a time switch brings it into operation half an hour before the works open each morning.

In the accompanying photograph the cable connected to the pipe run by a welded lug is shown on the top right. On the left of the controlling thermostat are valves and couplings above each of the refiners. At the bottom of these is an outlet from which the liquid chocolate is pumped by a portable motor-driven pump via a flexible hose to the pipe-line through which it flows into the mixing kettles on the opposite side of the factory.



Liquid chocolate conveying system at British Couverture Co.'s works

Commerce and Industry

Machine Tools and Defence Programme

Power Workers' Wages

A MEETING of machine tool merchants, convened by the British Association of Machine Tool Merchants, was held on 21st August, at which particulars were given of a scheme drawn up by the Association in conjunction with the Director-General of Machine Tools, Ministry of Supply. Mr. W. R. Clarkson, the president of the Association, introduced Mr. S. W. Rawson, the Director-General of Machine Tools, who gave the meeting a detailed statement of the needs of the defence programme and how vital it was that he should have available details of all second-hand machine tools in the "short supply" categories. He was certain that, if the scheme were operated by each machine tool merchant, it would assist considerably in achieving the requirements of the defence programme. The scheme provided for a liaison committee comprising initially seven representatives of the trade who would be available to give advice to him and for regional panels of experts to give technical assistance locally in connection with the use of second-hand machine tools. He urged the trade to operate the scheme.

Fair Trading in Australia

In order to counter the indiscriminate granting of discounts in the State, the Electrical and Radio Development Association of New South Wales has specified the classes of buyers to whom discounts should be granted. There are eight of these classes: four of them comprise the regular electrical contractors and retailers; the fifth includes electricity supply authorities and Government Departments; the sixth covers organizations employing a permanent electrical staff who purchase goods solely for use within their own organizations; and the seventh class is "any individual, firm or organization whose name or classification appears on a recognized electrical and/or radio trade list(s) but only in respect to the classified goods appearing in such list(s)."

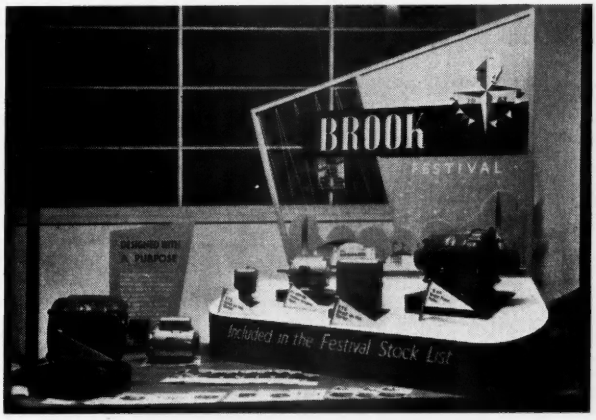
The eighth category is "Co-operative societies which have electrical and/or radio departments and operate within the Government legislation governing their activities and which only disburse dividends from their activities to shareholders as provided for by the appropriate Act."

Television for Denmark

The Copenhagen Correspondent of the *Financial Times* reports that a decision in favour of a regular television service in Denmark was taken by the Council of State Radio on 28th August. Viewers will pay a Kr.1.50 yearly licence from 1st October, when programmes are expected to begin. In order to encourage export of Danish television equipment not more than 1,500 sets are likely to be available for the home market during the first year.

Festival Window Display

In the accompanying picture we show one of the window displays arranged by Brook Motors, Ltd., at its London office at Palmer Street, Westminster. It depicts motors and starters which have been included in the Festival Stock



One of the window displays at the Westminster office of Brook Motors, Ltd.

List. Another of the display windows shows a selection of the company's control gear, and the winding of an electric motor stator with synthetic resin covered wire. A notice draws attention to the fact that the company produces 250,000 electric motors a year.

Increased European Production

A statement was issued last week on behalf of the eighteen Western European Governments (including Britain) which are members of the Organization for European Economic Co-operation (O.E.E.C.) affirming their ability to increase production by 25 per cent in the next five years and thus improve living standards while meeting defence requirements. They gave as the immediate aim an increase in the production of coal, steel and electricity, upon which greater industrial output is dependent, together with larger agricultural production.

Australian Switchgear Contract

The State Electricity Commission of Victoria has placed an order with the Metropolitan-Vickers Electrical Co., Ltd., for thirty-one units of metalclad switchgear type SB14. These equipments are for 20 kV service at the Newport "A" power station and are of the single-bus type with a rated short-circuit capacity of 750 MVA. They are to operate initially on 25 c/s service but later must work on 50 c/s; short circuit tests have confirmed that the circuit breaker performance is satisfactory on both frequencies.

Transmitters for Egypt

An £80,000 order from the Egyptian Ministry of Communications for one of the new 100 kW medium frequency air-cooled broadcast transmitters has been received by Marconi's Wireless Telegraph Co., Ltd. The transmitter is to be installed at Abu Zaabal, near Cairo, and will be housed in the same transmitter hall as the Marconi 100 kW high frequency transmitter, now being delivered to the Egyptian authorities. The complete mast radiator is also being supplied by Marconi's and will be erected by local labour under the supervision of British engineers. The Egyptian Government has also ordered from the Marconi Co. a 3 kW medium frequency beacon transmitter, type WB8, with full mast, aerial and earthing equipment, for installation on an Egyptian airport. This order follows closely an earlier order from Egypt for similar equipment.

Power Workers' Wage Increase

A basis of settlement of the dispute between the British Electricity Authority and manual workers employed in a number of power stations, which led to the banning of overtime by the men, was announced last week by the National Joint Council for the Electricity Supply Industry. As a compromise between the 10 per cent increase claimed and the 5 per cent offered by the B.E.A. it was decided to make an addition of 2d an hour to the wages of the men concerned, retrospective to 1st June.

The announcement was accompanied by a statement strongly deprecating the "unofficial" action taken by the men in refusing to work overtime. It was hoped that the offer would be accepted and that overtime would be resumed. The increase in wages has not, however, had the desired effect generally. Of 40 stations affected, at only six (three in Manchester) have the men decided to remove the ban on overtime working.

Work Without Pay

Electricians at the local depot of the London Electricity Board who have been involved in a dispute with the Board since February last agreed last week to finish installation work at the Greenways estate, Bethnal Green. The dispute arose out of the "upgrading" of a non-member of the Electrical Trades Union as an electrician. The men stated that they would finish the work to enable families to move into the flats but would not accept payment, as the dispute continued.

Carnival Tableau

At this year's Carnival at Southend-on-Sea, E. K. Cole, Ltd., entered a decorated lorry which portrayed the company's silver jubilee. With its framework of flowers and ten attractive Ekco girls, the tableau represented "Twenty-five Years of Progress," and showed Ekco models ranging from a 1926 radio set to the company's latest television receiver.

The entry of E. K. Cole, Ltd., in the recent Carnival at Southend-on-Sea

Equipment for Poplar Power Station

The 250-ton motor-barge *Success* left Hythe Quay, Colchester, last week for the new power station at Brunswick Wharf, Poplar, taking the first consignment from F. W. Brackett & Co., Ltd., Colchester engineers, ever to go to London by the sea and river route. The reason was that the site for the new power station was so crowded and hemmed in by other buildings that it was impossible to bring any lorries near enough for equipment to be placed in position. The site is more accessible from the Thames. For two days a heavy mechanical crane was loading the equipment, which consisted of twenty frame sections and a number of special fittings making up the water screen for the power station's condensers. The steel sections weigh between 25 cwt and three tons each and the total load on the barge was about 70 tons. They were specially packed into the barge so that, on arrival at Brunswick Wharf, they could be unloaded straight into position. Fitting is expected to take about two months. The accompanying picture was taken by the *Essex County Standard*.

A frame section of a water screen, made by F. W. Brackett & Co., Ltd., being loaded on a barge for the new Poplar power station

Holme Moss T.V. Station

Full-strength tests of the 45 kW Holme Moss television transmitter began on Monday last when the Alexandra Palace programme was put out in the morning. The official opening by the Postmaster-General (Mr. Ness Edwards) has been fixed for 12th October; the ceremony will be held in the Manchester Town Hall when Lord Simon of Wythenshawe, chairman of the B.B.C. governors, and Sir William Haley, director-general, are expected to be present.

Test transmissions take place each morning between 10 a.m. and midday (excepting Sundays) until 10th September. After this they will be extended to include the afternoon programmes.

E.D.A. Film Award

The Committee of the International Venice Film Festival has awarded first prize to Britain for the greatest number of scientific and art documentary films. Included among these films was one from E.D.A.'s educational series, "Magnetism," which was awarded first prize in the physics section.

Instrument Training Courses

For many years George Kent, Ltd., have made a practice of giving a thorough training to individuals sent to their Luton works by user firms. They have now begun a series of integrated courses for instrument mechanics and engineers from customers, to give this training on a more centralized basis. The courses last for four or five weeks, during which period whole-time instruction is given by a qualified training staff on the theory, operation and maintenance of a wide range of Kent instruments and control apparatus. A workshop and lecture room have been specially provided. Firms wishing to send employees on these courses should address their inquiries to the Training Officer, Luton.

Piezo-Electric Glossary

Supplement No. 5 to B.S. 204, which is a glossary of terms used in telecommunication, defines a short series of terms—engineering rather than crystallographic—employed in connection with the preparation of piezo-electric crystal apparatus. This supplement is obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 1s post free.

Cable Under the Dovey

In the article on this subject in last week's issue it was erroneously stated that the work was carried out in the South Wales Electricity Board's area. The district is, in fact, in the area of the Merseyside and North Wales Board.

Strike at Shipyard

Sixty electricians employed by Bartram and Sons, Sunderland shipbuilders, last week went on strike in support of their claim for a wage increase from £6 17s 6d to £7 10s weekly. The firm reached an agreement with the Electrical Trades Union for a minimum of £6 17s 6d, the introduction of a payment by results scheme

and provision for higher payments, but this was not accepted by the men. For one day work at the yard was brought to a standstill when the rest of the employees, numbering 1,000, stopped work because the yard security officer, a former policeman, had been doing electrician's work. The firm agreed to withdraw the man from this work.

Lift Engineers Return to Work

The 1,400 London lift maintenance engineers who have been on strike since 9th August returned to work last week. The Engineering and Allied Employers' Federation and the Electrical Trades Union are to meet on 14th September to discuss the claim for a pay increase of 6d an hour for all grades.

Electrical Maintenance at Plymouth

At present the whole of the electrical maintenance work on the Plymouth Corporation's housing estates is carried out by the South Western Electricity Board. Now, however, the City Council has agreed that maintenance work in connection with 3,000 houses (a quarter of the total) shall be done by a group of local electrical contractors who have formed a company, Electrical Contractors (Plymouth), Ltd., for the purpose. The Housing Committee, which is responsible for the policy, will review the position at the end of twelve months beginning 1st October and will then decide whether to extend or discontinue the arrangement.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £124 0s 0d
COPPER, H.C. Electro	ton £234 0s 0d
Fire Refined 99·7 per cent ..	ton £233 0s 0d
Fire Refined 99·2 per cent ..	ton £232 10s 0d
COPPER Tubes	lb 2s 2¾d
Sheet	ton £284 10s 0d
H.C. wire and strip	ton £261 15s 0d
LEAD, English	ton £181 10s 0d
Foreign	ton £180 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £955 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1½d
Sheet	lb 2s 4⅞d
Wire	lb 2s 7⅞d
PHOSPHOR BRONZE	
Wire	lb 3s 6½d
RUBBER, No. 1 R.S.S. spot ..	lb 45¼d–45⅝d

Trade Announcements

A. B. Metal Products, Ltd., have moved their London office to larger premises at 16, Berkeley Street, W.1. (telephone : Grosvenor 5206/7).

The Electrical Wholesale Supply Co. (Leicester), Ltd., has moved to larger premises at Ewesco House, 90, Highcross Street, Leicester (telephone 22598).

The office and showrooms of **E. J. Schofield & Co., Ltd.,** have been removed to 61, Bridge Street, Manchester, 3 (telephone : Blackfriars 4558).

The address of **Cooper & Co. (B'ham), Ltd.,** is now Brynmawr, Breconshire (telephone : Brynmawr 312).

The Glasgow branch of the **Stearn Electric Co., Ltd.,** has been re-opened at 664/666, Argyle Street, Glasgow, C.3, under the management of Mr. J. McCulloch formerly of Elexcel, Ltd., and the General Electric Co., Ltd.

Mr. G. Johnson, 57, Keswick Road, Sheldon, Birmingham, 26 (telephone : Sheldon 2245), has been appointed by the **Wardle Engineering Co., Ltd.,** as its agent for Birmingham and the Midlands.

Catalogues and Lists

Young & Wildsmith, Ltd., 35, Little Russell Street, London, W.C.1.—Addenda and errata booklet for use in conjunction with general accessory catalogue.

Londex, Ltd., Anerley Works, 207, Anerley Road, London, S.E.20.—Leaflet 245/B describing some special-purpose relays.

Bailey Meters & Controls, Ltd., Progress Way, Croydon.—Illustrated catalogue E230 presenting the Bailey "Calortron" electronic resistance thermometer.

The Plessey Co., Ltd., Ilford, Essex.—A new range of industrial hydraulic pumps is described in the latest publication, No. 455.

Keith Blackman, Ltd., Mill Mead Road, London, N.17.—Illustrated leaflet on "Tornado" air circulators and fans.

Changes of Name

Aberdare Cables, Ltd., have changed their name to Aberdare (Cable Holdings), Ltd. The name of A.X.C., Ltd., has been changed to Aberdare Cables, Ltd.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Mercoid" thermostats.

Electrically heated curling tongs.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Engineering in Europe

Survey of Current Literature

THE equipment of the Kuibyshev and Stalingrad power stations with circuit-breakers for 400 kV and a capacity of the order of 10,000 MVA necessitated tests on experimental types and models, as the sizes and ratings of the actual breakers excluded any possibility of direct tests in the system or laboratory tests with impulse generators. Partial tests on individual breaks of the circuit-breaker do not constitute any reliable evidence of the suitability of the switchgear as a whole under fault conditions in actual service. All the known circuits for " synthetic " testing do not supply the required information for establishing the breaking capacity either, because in none of these circuits is the parallelism with system conditions carried far enough, especially where the conditions during voltage recovery are concerned. However, four years' work in the h.v. laboratory of the Leningrad Polytechnical Institute led to the development of a dual-frequency oscillation circuit in which the fault conditions in a power system can be successfully simulated, without the use of impulse generators, but simply by the appropriately controlled charge and discharge of a capacitor battery. This enables tests to be carried out on a reduced scale (of, say, 1:10 or 1:8) and still to obtain full correspondence between the test conditions and those of actual service.—" Dual-Frequency Oscillating Circuit for Testing Very-high-capacity H.V. Circuit-Breakers for Breaking Capacity," A. A. Gorev, V. V. Kaplan and V. M. Nashatyr, *Elektrichestvo*, No. 6, pp. 5–12, June, 1951, in Russian.

Transformer Tests

In the U.S.S.R. the standardization of the testing and breakdown voltages of insulation is based on the following data: (1) the maximum of the permissible sustained operating voltage; (2) the theoretical level of the internal surges to be expected in power systems with large or small short-circuits to earth; (3) the impulse testing voltage of the external and internal insulation. In addition, it is assumed that the testing voltage at the commercial frequency of the internal insulation of transformers and apparatus should be equivalent to the impulse testing voltage and should assure the resistance of the external insulation to external voltage surges. The impulse testing is based on the assumption that the insulation of machines and apparatus may be reliably protected from atmospheric surges by thyrite arrestors. Also it has become an established practice in the U.S.S.R. either to insulate, or to earth through an arc quenching coil, the neutrals of the transformer in systems of up to 35 kV (which have small s.c. currents to earth), but to use direct earthing for the neutrals of part of the transformer in systems of 110–150 kV and of all the transformers in 220 kV systems. This article gives draft standard tables based on these principles. —" Problems of the Standardization of Test and Breakdown Voltages of H.V. Transformers, Apparatus and Insulators," A. N. Sherentsis, *Elektrichestvo*, No. 6, pp. 70–74, June, 1951, in Russian.

Earth Electrodes

The low-frequency resistance of bad soil ($\rho \cong 3{,}000\ \Omega$m) is very sensitive to the density of packing of sand around an earthing electrode and may differ by as much as 65 per cent between loose and compacted sand. This is one of the reasons why the l.f. resistance measured after laying down an earthing electrode is a very uncertain indication of the earth resistance. Only when the earth poured on an electrode has set in the course of time, so that it corresponds with natural soil, may the l.f. resistance become useful for assessing the quality of an earth. There is no clear relation between l.f. and impulse resistance either, as their variations do not run parallel. The measured surge impedances of a 15 electrode bedding seemed to depend on the measuring voltage and to decrease with increasing voltage. This decrease was least for a smooth " cable " buried at a depth of 25 cm, the surge impedance being 140 Ω at 150 kV. The

same " cable " buried 60 cm deep had only 60 Ω impedance. The corresponding values for barbed wire were 80 and 65 Ω, respectively. As regards electrode treating materials, it was found that ground charcoal, or charcoal dust, was best for reducing the surge impedance. The influence of magnetic powder is felt only in the initial part of the impedance curve; at higher voltages the impulse impedance of a smooth cable in magnetic powder is considerably higher than that of barbed wire packed in charcoal. There is no difference in the effect between a homogeneous layer of treating material and a mixture of sand and treating material, as the two curves coincide. Suitable treating materials should be chemically inert and should not attack the galvanized towers and copper electrodes nor act as electrolytes. Magnetite powder is superior to charcoal, but only at high current densities, so that in the overall performance charcoal answered best (up to 150 kV and 2,000 A) not least because of its cheap price. Where electrode form is concerned, barbed wire has certain advantages which are enhanced by the length of the barbs, yet a smooth " cable " embedded in charcoal is better than barbed wire without treating material.—" Surge Impedances of Various Earth Electrodes and Electrode Treating Materials," H. Norinder and O. Salka, *Bulletin*, Ass. Suisse des Electriciens, Vol. 42, No. 10, pp. 321–327, 19th May, 1951 (9 illustrations), in German.

Coil Edges in Oil

Coil arrangements of modern h.v. transformers were reproduced in a model, including the solid leakage channel insulation in contact with the windings. The critical disruptive voltages at which the first preliminary discharges along the coil edges occurred were measured and oscillograms were taken by C.R.O. Direct visual observations were also possible through a glass window in the oil tank. Since the initial discharges are creeping discharges along the surface of the solid interwinding insulation, the curve of the disruptive voltage has a flat ascent, the slope depending on the spacing of the windings. Dreyfuss's formula of the breakdown voltage in oil between bare metal electrodes does not apply here. The field configurations were also mapped out in the electrolytic tank on considerably magnified models and the field strengths in the oil and the paper insulation determined for the instant of the breakdown. It was found that not the maximum field strength, but the tangential voltage gradient along the insulating wall in contact with the coil, determines the discharge inception. An examination of the coils after the test showed that even comparatively weak pre-discharges leave minute traces on the insulation. This makes it imperative to stipulate that the critical disruptive voltage of any insulating arrangement must be at least as high, but preferably higher, than the test voltage.—" Investigations on Discharge Inception on Coil Edges of H.V. Windings in Oil," K. Hurrle, *Arch. Elektrotech*, Vol. 40, No. 2, pp. 75–88, 1951, in German.

" Synthetic " C.B. Testing

Investigating of the arc process in an a.c. circuit-breaker with a view to establishing the conditions to be satisfied by any set-up for " synthetic " circuit-breaker testing, working with separate voltage and current sources, for a faithful reproduction of the actual electric stresses on the circuit-breaker in operation, the author uses a sub-division of the critical stage in arc extinction into four parts, first suggested by A. M. Cassie (C.I.G.R.E. Report, 1939). This method enables the varying arc conditions to be represented by the most appropriate, and also simplest, type of arc equations for each successive important phase and the energy necessary for simulating these phases of the process to be computed at least in a first approximation. The latter is the purpose at which the author aims, in order to show at least in simplified theory that, and how, these energies may in principle be supplied by the controlled combination of two separate sources. Useful parallels are drawn with the energy relations in direct tests. In this way the results obtained point out a possible way of developing " synthetic " test circuits step by step by using data and relations deduced from direct tests and of arriving at a definitive assessment of the usefulness and conclusiveness of the indirect method.—" Considerations of the ' Synthetical Method ' of Testing A.C. Circuit-Breakers," S. B. Toniolo, *L'Electrotecnica*, Vol. 38, pp. 258–265, June, 1951, in Italian.

[Readers may arrange, by request, to obtain accurate full translations of any of the articles abstracted in this section, at the usual rates.—Editors, *Electrical Review*.]

Fire Hazards

Points from Research Report

FURTHER details of investigations of of all kinds of fire hazards, backed by laboratory studies and experiments, are given in the annual report of the joint research organization of the D.S.I.R. and Fire Offices Committee, entitled "Fire Research in 1950" (H.M. Stationery Office, price 2s 8d post free, or 65 cents in the United States).

Table I—Supposed Electrical Causes of Fires in Houses

Supposed Causes of Fires	No. of Damaged Dwellings per 10,000 at Risk per Year					
	Temporary Houses		Permanent Houses Non-Traditional		Traditional	
	1947	1949	1947	1949	1947	1949
Electric cookers ..	0·5	1·5	—	0·6	0·1	0·2
Other electrical apparatus	0·7	0·9	2·7	0·6	0·4	0·2
Wires and cables ..	2·1	3·2	—	0·7	0·3	0·1

Supposed causes of 42,792 fires inside and 59,036 outside buildings during 1949 are tabulated: 104 inside and 72 outside were attributed to lightning; 24 inside but none outside (nine in 1948) to static electricity; 744 to electric cookers; 900 to electric fires, heaters and radiators; 436 to electric irons; 180 inside and 20 outside to motors; 1,108 to refrigerators; 2,680 inside and 2,352 outside to wires and cables; 444 to wireless apparatus; 736 inside and 224 out to other electrical apparatus.

During the six years 1944–49 large fires caused damage to the extent of £1·7 million on premises occupied for the manufacture of electrical installations, cables and apparatus. A feature revealed by statistical study was the low rate of incidence of fires (defined as the number of damaged dwellings per 10,000 dwellings at risk per year) in post-war traditional houses as compared with those in other types of dwellings. Table I indicates the number of fires of supposedly electrical origin as defined above.

The ratio of the rate of incidence of fires caused by television sets to that of fires due to wireless sets (Table II) diminished from 31 : 1 in 1947 to 19 : 1 in 1948, and to between 5 : 1 and 20 : 1 in 1949.

A machine that simulates, by electrical networks, the transmission of heat through structures has been employed for estimating the thickness of asbestos sprayed on to wood partitioning and an aluminuim bulkhead in ships, also of vermiculite plaster cement on walls, required to increase their resistance to fire for specified times. The circuits devised for this purpose, which accurately represent convection and radiation losses, are being incorporated in another analogue being constructed on optical principles for indicating the temperature within a material when its surface is irradiated. These machines will save intricate and laborious mathematical calculations.

An analysis, made at the request of the Chief Electrical Inspector of Factories, of fires caused by faults in fluorescent lighting

Table II—Rate of Incidence of Radio Fires

Type of Set	Year	No. of Fires	No. of Sets at Risk per Year (Thousands)	No. of Fires per 10,000 Sets at Risk per Year
Wireless	1947	232*	10,834	0·21
	1948	331*	11,203	0·30
	1949	392* ± 68	11,688	0·34 ± 0·06
Television	1947	12	18·8	6·4
	1948	30	53·9	5·6
	1949	52 ± 25	104·5	3·7 ± 1·8

* These totals included fires caused by radiograms

equipment revealed 16 incidents in the first six months of 1950. Seven of them started in a choke, one in a condenser, one in a transformer, one in a broken bayonet connection and another in a " starting motor "; the positions of five more are not reported. In twelve of the incidents damage was confined to the electrical equipment. In only one incident, in a flax factory, did the fire spread and cause serious damange.

Fire resistance tests of materials included a comparison of electric wiring insulated respectively with rubber and a plastic substance. Neither type ignited when electrically overloaded to twelve times the rated 5 A capacity, but the plastic-insulated type was " markedly superior " in respect of resistance to spread of flame when externally ignited.

Continuing investigation of water sprays indicates that flame-extinguishing effectiveness depends upon size of drops within the spray.

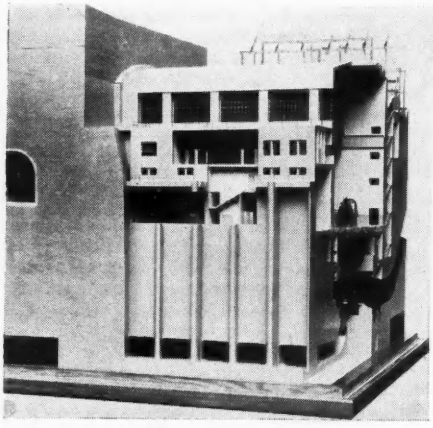
Hydro-Electric Plant for Spain

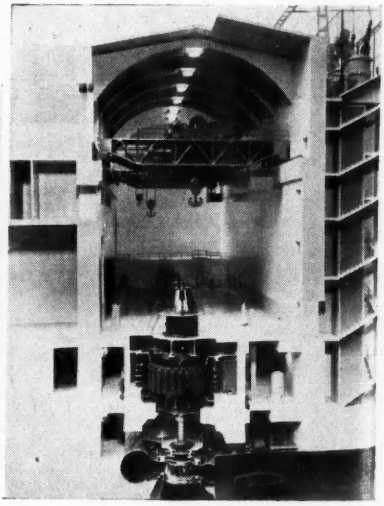
THE main attraction of the current window display at the London office of the British Thomson-Houston Co., Ltd., at Crown House, Aldwych, W.C.2, is a scale model of the Los Peares hydro-electric power station for Fuerzas Electricas del Noroeste, S.A. Spain.

As main contractors for the generating plant, transformers and switchgear, the B.T.H. Co. designed, and is manufacturing, the three vertical 62,400 kVA, 11 kV, three-phase alternators; the 11/132 kV and 132/20 kV transformers; the 20 kV and the 132 kV switchgear, including the miniature control panels; also the 380 V station auxiliary gear. The Francis type water turbines are being constructed by Boving and Co., London, as sub-contractors to B.T.H. Each turbine develops 72,800 b.h.p. at 214 r.p.m., with 300ft head of water, which reaches the turbine through a main valve at the end of a pipe over 13ft in diameter, buried in the concrete of the dam. The weight of a complete alternator is 400 tons, the rotor accounting for 250 tons. The outside diameter of the stator is 24ft and the overall length of each complete set (including the turbine) is 59ft.

The alternators are connected through 11 kV isolators to transformers mounted on a platform at an upper level of the station, where the alternator output is transformed from 11 kV to 132 kV. The transmission lines on the platform lead to a switching station above the dam where the incoming and outgoing transmission lines are connected.

A model of the Los Peares hydro-electric power station, Spain, which appears in the window at the London office of the B.T.H. Co., showing *(left)* **the layout of the station and** *(right)* **one of three generators which are to be installed**





ELECTRICITY SUPPLY

Inquiry into Proposed 275 kV Line

Peak Load Economy Plans

THE Ministry of Fuel and Power has announced that an inquiry is to be held to hear objections to the proposed erection of a 275 kV line from Carlisle to Blaydon-on-Tyne. The inquiry will be held under the 1919 Electricity Act and although this Act provides for objections to be heard from statutory bodies, the Ministry is prepared to hear the views of non-statutory bodies like the Ramblers' Association, the Council for the Preservation of Rural England and the Northern Architectural Association. The inquiry will be held at the County Hall, Newcastle-on-Tyne, but no date has been given for its opening. So far objection has been based on the grounds that the proposed overhead line will interfere with the amenities of the Roman Wall area. Landowners and farmers are opposing the suggested route.

North Wales Projects

The North Wales Hydro-electric Protection Committee held a meeting last week. Major G. Haythornthwaite announced that there was no reason to hope that the schemes of hydro-electrification would not be proceeded with. Trial holes were being made at Cwm Dyli and at Lakes Llydaw and Ogwen, showing that the survey of Snowdonia was being continued. The Protection Committee would petition against each Bill that might be promoted in Parliament. It would be necessary to raise £5,000 for legal and other work in connection with the opposition.

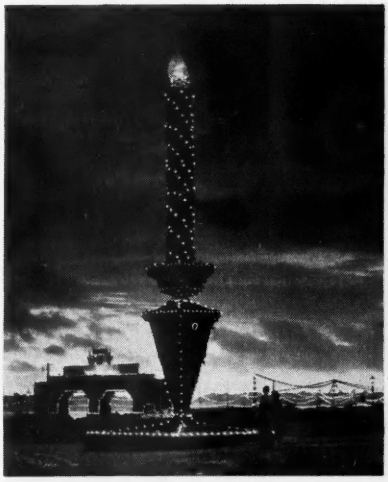
Jersey Illuminations

Among the features of this year's Battle of Flowers in Jersey was a gigantic illuminated "candlestick" (nicknamed "The Candlon") erected in the Triangle Park. This comprised a 50ft wood pole upon which a framework was erected to carry a spiral of striplighting. At the top was a "flame" of 140 W sodium vapour lamps surrounded by coloured rings, all encased in translucent "Windolite," with a moving "smoke" plume of the same material.

All the work was done in their own time by members of the staff of the Jersey Electricity Co., Ltd. (engineer and manager, Mr. H. H. Longson, M.I.Mech.E., A.M.I.E.E.) and flowers and foliage were contributed by voluntary helpers.

The company's Contract Department was responsible for general illuminations during the Battle of Flowers and floodlighted the Mont Orgeuil Castle at Gorey.

The picture is reproduced by courtesy of the Jersey *Evening Post*.



The Jersey "Candlon"

Rota Cards

Load shedding rota cards are being distributed by meter readers to over a million domestic and business consumers in the Yorkshire Electricity Board's area. Consumers are divided into five groups, A to E, and the rota schedule has been designed so that as far as possible an equal contribution to economy during peak periods will be made by all consumers.

Spen Valley Load Spreading

At a meeting at Cleckheaton last week the Joint Electricity Committee for Brighouse, Spenborough and Heckmondwike decided to recommend a five-group scheme of load spreading for the coming winter. The scheme would involve each group working four days and one evening shift per week.

LAMP CAMPAIGNS

Further Arrangements for the Lighting Season

SEVERAL new sales aids have been prepared by CROMPTON PARKINSON, LTD., for its new lamp publicity campaign which has just been launched. "Switch to Crompton Lamps" is the slogan on 16-sheet posters spread nation-wide and once again the message will appear in the large circulation daily and weekly newspapers and periodicals. For the stockists this season's main attraction is the new Crompton "live" counter display with three lamps—a single-coil plain, a coiled-coil pearl and a "Whitelight"—in holders concealed within cartons, each controlled by a working replica of the "cheerful" switch that appears in all Crompton lamp advertising. Customers can switch on one lamp at a time and see for themselves the difference in the light quantity and quality. The working display is being lent free. Another novelty for stockists is the full-colour slogan banner with a string of lamp cut-outs spelling the name "Crompton." Designed to fit any window or any position inside the shop, it is adjustable from a minimum length of 5ft to a maximum of 12ft.

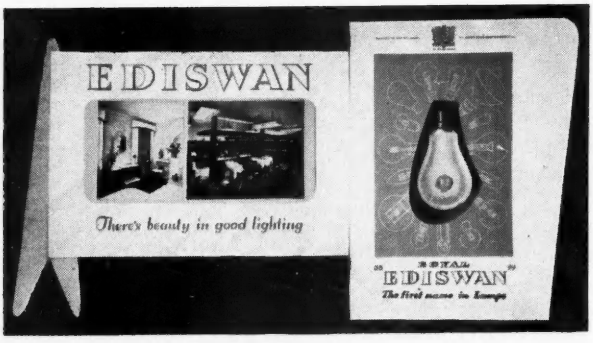
The new full-colour window display is 3ft 6in high and, to make the most of the space available, the display is adjustable to a width between 3ft and 6ft.

Other publicity for stockists includes a full-colour two-plane counter card, 18in high by 9in wide; an "at-a-glance" price card for assistants and customers; a new window transfer; and a circular slogan disc that adheres to glass doors and windows without having to be stuck. Literature comprises a price leaflet for the counter or mailing in account envelopes, a 24-page price list covering the whole range of Crompton lamps, and an up-to-date edition of the vest-pocket price list for shop assistants.

A new Crompton counter display

For car bulb publicity there is a novelty show-card, a special window transfer and for the counter or inclusion in account envelopes a folder giving full details of Crompton car bulbs.

New material proposed by the EDISON SWAN ELECTRIC CO., LTD., includes a special window display unit constructed in cellulose finished hardboard, fitted with drop hinges in the centre for ease of packing. Its dimensions are 5ft 3in by 3ft. There is also an effective counter unit drawing attention to the three types of lamps in general use. Another attractive sales aid is a double-sided lamp illuminated box sign finished in cellulosed bronze for supply to dealers. As in previous years this publicity material will be supported by advertisements in trade journals and magazines.



A new "Ediswan" window display unit

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The Electric Furnace Co., Ltd., reports a profit of £47,608 for 1950-51, before meeting taxation (against £37,213 for 1949-50). The available balance, after adding dividend from subsidiary company, etc., and deducting income and profits tax, is £24,827 to which is added £26,168 brought forward, making £50,995. A sum of £18,000 is transferred to general reserve (against £12,000), a final dividend of 5½ per cent is declared on the preferred ordinary and ordinary shares (making 10 per cent, against 8 per cent) and £24,214 is carried forward. In his statement, to be presented at the annual meeting on 25th September, the chairman (Mr. D. F. Campbell) says that all three sections of the company have contributed to the improved results. The Electro-Chemical Engineering Co. has made a useful contribution to group profits and has a very largely increased volume of orders. Associations with American firms for the exchange of technical information have been strengthened and the "Udylite" bright nickel plating process has continued to develop rapidly. Concentration of the group's manufacturing and heat-treatment facilities at Burton-on-Trent has proved satisfactory; the extensions at Burton are approaching completion and an additional building is being erected.

John Brown & Co., Ltd.—In the course of his speech at the annual meeting on 31st August Lord Aberconway (chairman) referred to the company's progress in gas turbine research and development. He said that the 12,500 kW set for the North of Scotland Hydro-Electric Board, at Dundee, was expected to be running next year. The company's experimental units had run for many hours and work was well advanced on the burning of coal and peat. A turbine for waste heat recovery from an industrial process had been designed and was now in course of manufacture. The engine works had undertaken in co-operation with the subsidiary, Markham & Co., the construction of large water turbines for the Scottish hydro-electric schemes and for other parts of the world. The company had been asked by the British Electricity Authority to undertake the manufacture of the largest size of land boiler. Contracts were accepted and the company was erecting works at Whitecrook, near its Clydebank shipyard, to make some of the principal parts of these boilers. The company, in conjunction with other financial partners, was participating in the establishment of an electro-chemical industry in Southern Rhodesia. The new company, Rhodesian Alloys, Ltd., should be in effective operation towards the end of next year.

Hackbridge Cable Holdings, Ltd., reports group profits for the year ended 31st March last of £193,417, as compared with £274,437 for the preceding year, and after deducting taxation of £122,170, the net profit is £71,247 (against £123,000). It is proposed to pay a final ordinary dividend of 12½ per cent, maintaining the distribution for the year at 20 per cent. In his statement Mr. C. I. Steen (chairman) says a good deal of thought was given by the board to the final dividend, but it was their belief that the present setback should only be temporary. Future prospects will be dominated by the raw material position. The turnover for the first four months of the current year has shown a substantial improvement over the corresponding period of last year, but this has been achieved at the expense of running down very considerably the normal stock of raw materials. The order book is at a record high level.

Richardsons, Westgarth & Co., Ltd., report a consolidated trading profit for the year ended 31st March last of £682,990, as compared with £643,421 for 1949-50, and after deducting depreciation, £356,900 for taxation, and £935 retained by subsidiaries, the parent company's net profit is £240,851 (against £279,438). The dividend for the year is unchanged at 12 per cent, but is payable on increased capital. General reserve receives £125,000 and superannuation reserve £25,000. The balance carried forward is £133,449 (against £126,200 brought in).

Berry's Electric, Ltd., shows a trading profit of £113,497 for 1950-51 (compared with £84,464 in the preceding year) and a net profit of £89,086 (against £60,600). After the deduction of income and profits tax and the transfer of £32,351 (against £17,000) to general reserve, an ordinary dividend of 12½ per cent (against 10 per cent) is to be paid, leaving £11,428 to be carried forward. Since the last annual meeting Messrs. A. Shelton and J. W. Reid have retired from the board and Messrs.

B. H. Killinger and J. J. Thompson have been appointed to the vacancies. Meeting, 2nd October.

The Reason Manufacturing Co., Ltd., reports a profit for the year to 31st January last of £4,148, as compared with £4,145 for the preceding year. Taxation requires £769, and tax reserve receives £521. The ordinary dividend for the year is unchanged at 20 per cent, and £15,574 is carried forward (against £14,616 brought in).

T. Clarke & Co., Ltd., state that the increase in their business and that of their subsidiary, T. Clarke & Co. (Liverpool), Ltd., makes it desirable to raise further capital on a permanent basis in order to finance the increase in activities. Ordinary shareholders are offered 154,538 ordinary shares of 2s each at 4s per share in the proportion of one new share for every four shares held. The shares now offered will not rank for the interim dividend of 9 per cent, declared on 25th July last, but will rank in all other respects *pari passu* with the existing issued shares.

Engineering Components, Ltd., has declared an interim dividend of 10 per cent (same). The directors state that the Capital Issues Committee has sanctioned a scrip bonus issue of £125,000 in the proportion of one for one.

The British Oxygen Co., Ltd., has declared an interim dividend on the ordinary stock of 8 per cent, less tax (same).

Brown Brothers, Ltd., are paying an unchanged ordinary interim dividend of $2\frac{1}{2}$ per cent.

New Companies

Ross & Smith (Electrical Engineers), Ltd.—Registered in Edinburgh 22nd August. Capital £5,000. Electrical engineers, etc. Subscribers: J. A. Tulloch, 24, Caperstown Crescent, Aberdeen and J. A. Gillan, Powis Circle, Aberdeen.

Bankfield Engineering (Electronics), Ltd.—Registered 23rd August. Capital £1,000. Manufacturers, wholesalers and retailers of electronic and electrical equipment as used in radar, radio, television and communications industries, etc. Directors: D. W. Beaver and W. Smith. Regd. office: 1, Houghton Street, Southport, Lancs.

H. & A. Orton, Ltd.—Registered 28th August. Capital £1,000. Electrical engineers, and general electrical installation contractors, lighting specialists, etc. Permanent directors: H. A. Orton (managing director) and Mrs. G. M. Orton. Secretary: Mrs. G. M. Orton. Regd. office: Queen's Hotel Yard, Market Street, Ashby de-la-Zouch.

Meredith Electrical Services, Ltd.—Registered 24th August. Capital £1,000. To acquire (1) the business of electrical contractors and wireless specialists carried on by H. C. Meredith at 175, Plashet Grove, E.6 and (2) the business of fancy goods dealers carried on by the said H. C. Meredith at St. Osyth, Essex. Directors: H. C. Meredith and Mary A. Meredith. Regd. office: 26/7 Conduit Street, W.1.

Increases of Capital

Aberdare Cables, Ltd. (Formerly A.X.C., Ltd.).—Increased by £609,900, in £1 ordinary shares, beyond the registered capital of £100. This increase is for the purpose of acquiring part of the undertaking and assets of Aberdare Cables, Ltd.

British Electrical Repairs, Ltd.—Increased by £50,000, in £10 ordinary shares, beyond the registered capital of £150,000. British Engine Boiler & Electrical Insurance Co., Ltd., hold nearly all the issued shares.

Meeting of Creditors

S.I.M. Electrical Co., Ltd.—Meeting of creditors 24th September at 10, Peacock Lane, Leicester, for the purposes mentioned in Sections 294 and 295 of the Companies Act, 1948.

Receiver Appointed

Johnson & Tanner, Ltd.—Mr. J. D. Shepard, of John M. Winter & Sons, 39, St. James's Street, London, S.W.1, was appointed receiver and manager by Lloyds Bank, Ltd., the debenture holders, on 20th August.

Winding-up Petition

Ranalah, Ltd.—A petition for the winding up of this company was presented on 27th August by Geo. Bray & Co., Ltd., and will be heard on 8th October at the Royal Courts of Justice, London. Any person who intends to appear on the hearing must notify Beale & Co., 22, Great Smith Street, Westminster, S.W.1, by 6th October.

Liquidation

Cornwall Radio & Television Co., Ltd.—Meeting of members on 3rd October at 1, Beachfield Avenue, Newquay, to receive an account of the winding up by the liquidator, Mr. D. C Ferry.

Bankruptcy

H. Gold (formerly Gelkop), 271, Evering Road, Clapton, radio and electrical engineer.—First and final dividend of 1s $10\frac{1}{4}$d in the £ payable on and after 6th September at the office of the trustee, 185-188, High Holborn, London, W.C.1.

STOCKS and SHARES

THE present quiet conditions in Stock Exchange markets provide an opportunity for looking back over the past eight months, in order to note the net price changes since the end of last year. Leading electrical equipment shares have reflected the general experience of industrial markets in continuing, on balance, the upward tendency established during 1950. Their best weeks followed the Budget, which was read as inflationary. Prices were kept in the ascendant, until the first part of June, by the best season of company reports and dividends published since the war. After a moderate reaction, quotations broke sharply when the Chancellor produced his dividend control proposal. Markets displayed remarkable resilience in recovering, within a month, most of that setback. Although many prices are well below the best of the year, the following table shows that the majority of first-rate industrials still retain decidedly useful appreciation on their value at the beginning of the year:—

Ordinary	December, 1950	31st Aug., 1951	Rise
	s. d.	s. d.	s. d.
Associated Elec. Ind.	85 0	86 9	1 9
Crabtree Electrical	39 0	41 3	2 3
Crompton Parkinson	11 6	12 0	6
Elec. Construction..	61 3	63 9	2 6
English Electric ..	47 6	64 6	17 0
G.E.C.	82 0	92 6	10 6
Lancs Dynamo ..	96 3	106 3	10 0
Reyrolle	76 3	82 6	6 3

Cables and Telephones

As a group, the shares of the principal cable manufacturing companies have lagged behind those engaged in the more general branches of electrical engineering. Raw material costs and shortages appear to present more than average difficulty to this section of industry. Telephone shares have held their popularity, and both these fields of enterprise continue to be ranked among the soundest for long-term investment. In the accompanying representative group it will be noted that Siemens, Telegraph Condenser and Automatic Telephone shares have gone ahead well, while others have maintained their value in the face of the dividend control proposal.

Ordinary	31st Dec., 1950	31st Aug., 1951	Rise
	s. d.	s. d.	s. d.
Automatic Tel. ..	62 0	72 0	10 0
Enfield Cable ..	32 0	33 6	1 6
Henley's	23 6	24 0	6
Johnson & Phillips	62 0	63 9	1 9
Siemens	31 3	43 0	11 9
Tel. Construction ..	42 6	43 9	1 3
Tel. Condenser ..	32 6	41 3	8 9

The Other Rises

Taking a mixed selection of shares in other companies connected with the electrical industry, the tendency is once more seen to be upwards. In the table given below C. A. Parsons stand out with a rise of 21s 3d. Decca and Cossor shares are both better. Tube Investments, after undergoing fairly sharp fluctuations, remained with a rise of 6s 3d on the eight months' business. Tokyo Electric 6 per cent bonds started this year at 63, and are now 40 points higher.

Ordinary	31st Dec., 1950	31st Aug., 1951	Rise
	s. d.	s. d.	s. d.
Brush	6 6	6 9	3
Cossor	11 3	14 6	3 3
Decca	13 9	19 6	5 9
Ever Ready ..	28 6	31 0	2 6
Lucas	33 9	38 9	5 0
C. A. Parsons ..	76 3	97 6	21 3
Tube Investments..	6 $\frac{15}{16}$	6 $\frac{1}{2}$	6 3
Walsall Conduits ..	56 3	62 0	5 9

Dividend Control

At the risk of appearing tiresomely repetitive, it may be added that in working out the yields on the shares quoted in the tables, an attempt has been made to calculate the average of two years' dividends, which would be the standard dividend should dividend limitation control come into force. A fortnight ago it was pointed out that, on a large number of ordinary shares in our lists, dividend rates and capital had remained unchanged over the two years which would set the standard for dividend control purposes. Complications arise, however, where a bonus has been distributed, either in the shape of free shares or shares offered at a bonus price. In all such cases, the yield overleaf is shown on the " estimated " standard rate.

"The Beetle Bulletin"

WE have received from British Industrial Plastics, Ltd., a copy of the first issue of " The Beetle Bulletin, to be published twice yearly. Its purpose is to keep executives up to date on developments in aminoplastics and in the plant, tools and processes used in their application. The publication is well produced and illustrated and contains examples of plastic mouldings in various industries, including mouldings for English Electric and Ferranti meters. Particulars are given of the company's product design and mould design advisory services.

Electrical Investments

Past Month's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price Aug. 31 1951	Month's Rise or Fall	Est. "Control" Yield p.c
Overseas Electricity Companies					£ s. d.
Atlas Elec. ..	3	4	20/9	−3d	3 17 1
Calcutta Elec. ..	6†	6†	22/6	+1/6	5 6 8†
Cawnpore Elec. ..	—	—	33/3	−6d	—
East African Power	7	7	42/-	+9d	3 6 8
Jerusalem Elec. ..	—	—	8/3	−6d	Nil
Madras Elec. ..	—	—	29/-	—	Nil
Nigerian Elec. ..	10	10	31/3	—	6 8 0
Palestine Elec. "A"	5†	5†	18/-	—	5 11 1†
Perak Hydro-Elec.	Nil	Nil	12/-	—	Nil
Whitehall Inv. Pref.	6	6	23/9	—	5 1 1
Equipment and Manufacturing					
Aberdare Cables(5/-)	20	20	14/3	+9d	7 1 7
Aron Elec. Ord. ..	15	15	42/6	—	7 1 2
Assoc. Elec. Ord.	15	20	86/9	+1/9	4 0 8
Automatic Tel.&El.	12½	15	72/-	+4/6	3 10 6
Babcock & Wilcox	15	18	77/3	+2/3	4 5 6
Baldwin, H. J. (2/-)	25	25	6/3	+3d	8 0 0
British Aluminium	10	10	43/3	+1/6	4 7 9
B.I. Callender's ..	6¾	7½	32/6	—	4 6 2
British Thermostat (5/-)	30	30	32/6	—	4 12 4
British Vac.Cleaner (5/-)	20	25	17/-	+9d	6 12 0
Brush Ord. (5/-) ..	10	10	6/9	—	7 8 2
Burco (5/-) ..	35	42½	24/6	+9d	7 18 0
Chloride El.Storage	12½	15	66/3	+7/6	4 3 0
Cole, E. K. (5/-) ..	20	25	21/-	+2/3	5 7 3
Cossor, A. C. (5/-)	Nil	Nil	14/6	+4/-	Nil
Crabtree (10/-) ..	17½	17½	41/3	+1/6	4 5 0
Crompton Parkinson Ord. (5/-) ..	22½	11½*	12/-	+6d	4 13 9
De La Rue (5/-) ..	50	50	35/-	—	7 2 10
Decca (1/-) ..	112½	112½	19/6	+9d	5 15 2
E.M.I. (10/-) ..	8	8	19/-	—	4 4 3
Electrical Components (5/-) ..	20	20	11/3	—	8 17 10
Elec. Construction	15	15	63/9	−9d	4 14 4
Enfield Cable Ord.	7½	7½	33/6	—	4 9 7
English Electric ..	10	15	64/6	+2/-	3 17 6
Ericsson Tel. (5/-)	20†	22†*	47/6	—	2 4 2†
Ever Ready (5/-)..	35	35	31/-	+6d	5 13 0
Falk Stadelmann	15	15	47/-	+9d	6 7 8
G.E.C. Ord. ..	17½	22½	92/6	+1/6	4 6 7
General Cables (5/-)	38	30*	18/3	+9d	8 4 4
Greenwood & Batley	15	15	52/-	−1/6	5 15 5
Hackbridge Cable (5/-)	20	20	13/-	−1/6	7 13 10
HackbridgeHewittic (5/-)	15	18	17/6	—	4 14 3
Hall Tel. Acc. (10/-)	10	10	13/-	−1/-	7 13 10
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (5/-) ..	20	20	24/-	+1/-	4 3 4
Hoover (5/-) ..	45	30*	31/6	+3/3	4 3 4
Intl. Combustion (5/-)	21	20*	21/6	+6d	4 1 5
Johnson & Phillips	15	15	63/9	+1/6	4 14 4
Equipment and Manufacturing (continued)					£ s. d.
Lancashire Dynamo	22½	22½	5⅛	+1/8	4 4 6
Laurence,Scott(5/-)	12½	12½	13/3	—	4 14 4
London Elec. Wire	10	10	48/3	+1/6	4 3 0
J. Lucas	17½	6⅝*	38/9	+1/6	3 4 5
Mather & Platt ..	11	12½	45/9	−6d	—
Metal Industries ..	10	10	44/0	+1/-	4 11 0
Mid. Elec. Mfg. ..	12½	15	60/-	—	4 11 8
Murex	10	12½	55/-	+6d	4 1 9
Newman Ind. (2/-)	10	6	2/9	— d	—
Oldham & Son (1/-)	30	30	5/3	+9d	5 17 8
Parsons, C. A. ..	15	15	97/6	+3/8	3 1 6
Plessey (5/-) ..	20	20	18/9	—	5 6 8
Pye Deferred (5/-)	35	18*	22/6	+1/6	3 19 6
Radio & Tel. (2/-)	—	—	9d	—	Nil
Revo (10/-) ..	27½	27½	43/9	—	6 5 9
Reyrolle	15	15	82/6	+½	3 13 0
Scophony Baird(1/-)	—	—	1/3	—	Nil
Scot. Cable (4/-) ..	30	30	24/6	—	4 17 9
Siemens Ord. ..	7½	10	43/9	+1/6	4 0 0
Switchgear&Cowans (5/-)	20	22½	16/3	—	6 10 9
T.C.C. (10/-) ..	15	20	41/3	+1/6	—
T.C. & M. ..	9*	10*	43/9	+⅝	4 6 6
Telephone Mfg.(5/-)	10	10	10/-	—	5 0 0
Thorn Elec. (5/-)..	20	10*	9/6	—	5 5 6
Tube Investments	25	25	6½	+⅜	3 17 0
Vactric (5/-) ..	Nil	Nil	10/9	—	Nil
Veritys (5/-) ..	2½	Nil	3/3	−3d	Nil
Walsall Conduits (4/-)	70	70	62/-	+2/-	4 10 6
Ward & Goldstone (5/-)	44	45*	42/6	−½	—
Watford (2/-) ..	20	25	7/6	+3d	6 0 0
Westinghouse Brake	14	14	60/-	—	4 13 4
West, Allen (5/-)..	10	12½	11/3	+6d	5 0 0
Transport and Communications					
Anglo-Am. Tel.: A Ord.	—	—	100	−2	—
Ord.	—	—	65	—	—
Anglo-Portuguese	8	8	24/6	—	—
Brit. Elec. Traction: Def. Ord. ..	22½	25	495	—	4 15 9
Cable & Wireless: Ord.	—	6	116	−1	4 14 10
4% Loan ..	4	4	100	—	4 0 0
Calcutta Trams ..	6†	6†	27/6	+⅛	4 7 3†
Cape Elec. Trams	6	4	17/-	—	4 14 2
Globe Tel. & Tel. Ord.	—	—	25/6	—	4 18 1
Great Northern Tel. (£10)	7½	8	11½	−½	6 9 2
Inter. Tel. & Tel.	Nil	15cts	37	+¼	—
Marconi Marine ..	7½	10	35/-	+1/6	5 0 0
Oriental Tel. Ord.	16	16	53/-	+1/-	—
Telephone Props.	7	8	33/9	+7/9	4 8 9
Tele. Rentals (5/-)	10	10	10/-	—	4 10 0

* After capital bonus.
† Dividends are paid free of Income Tax.

Greek Electrification Programme

From a Correspondent

AMONG the nations of Europe, Greece ranks as the lowest in per capita consumption of electricity, with the sole exception of Bulgaria. Now, however, the country is moving towards self-sufficiency in electric power, with work well started on an ambitious Marshall Aid programme.

The programme, to be completed by 1955, includes three hydro-electric and one steam-electric plants, together with transmission lines, substations and distribution systems. The hydro plants will be located on the Vodas, Ladhon and Louros rivers. The steam plant is being constructed near Aliveri, on the island of Euboea, next to a large deposit of lignite, which is being mined simultaneously to supply fuel for the power plant.

Power development in Greece has lagged far behind that of other western nations, with electricity mostly available only in the major towns, from oil-burning steam-electric and diesel-electric plants which consume about 500,000 tons of liquid fuel annually at heavy cost in scarce foreign exchange.

Even these plants are beginning to prove inadequate. Without the projected power system, Athens and Salonika—the main industrial sites—would be suffering from acute power shortage within a few years. Already the industrialization programme has undergone serious modification because of the power situation.

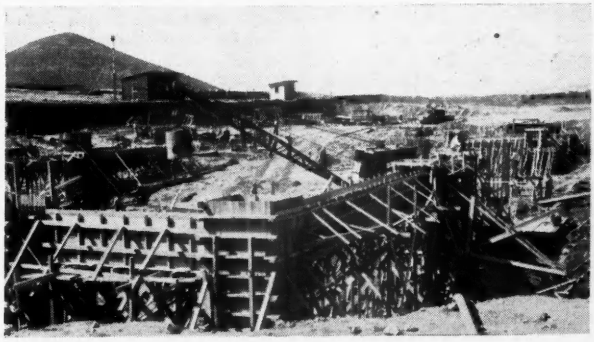
Outside the major cities, electric power is almost non-existent. A survey showed that, of 6,000 villages in Greece, only 300 had any form of electric power. Mostly, these villages possessed a small diesel generator set to drive a local sawmill or olive oil extracting plant during the day, with the electricity supplying a few dim lights in homes or shops for two or three hours in the evening.

Completion of the new programme will bring much-needed power to large areas of rural Greece, and supplement existing sources for the cities. One important result, economically and socially, will be the development of cottage industry, giving work to villagers who, for long periods of each year, are now unemployed except during planting and harvest times.

Another major contribution to Greek agriculture will be the future development of a nitrogen fertilizer industry. Such a plant is now proposed for the Ptolemais area in north-central Greece, where another great lignite deposit awaits exploitation. Fertilizer is used less than in any other European country, although years of cultivation have exhausted the Greek soil. Large supplies of cheap fertilizer would help to increase agricultural production.

Steam Plant

With all preliminary surveys completed and many contracts placed, the power programme is now going ahead. The Aliveri project, on the island of Euboea in Eastern Greece, includes an 80,000 kW



The concrete foundations of the Aliveri power station have been laid and work on the buildings is now in progress

plant consisting of two turbo-generator units each supplied by two boilers designed to burn the lignite which is mined nearby.

Construction has already started, in charge of an American company, Burns and Roe, in association with the Foundation Company, a construction organization. The German concern, A.E.G., has the contract for the turbo-generators and condensers, and the boilers are being manufactured by the American Babcock and Wilcox concern.

Development of the adjacent lignite mines is supervised by Pierce Management, Inc., mining consultants. The German firm of Philip Holtzmann has the contract for sinking the mine shafts. At present rates of construction, and subject to delivery of equipment as scheduled, production of power should begin during the fourth quarter of 1952.

A related project for the distribution of this power consists of 246 miles of 150 kV transmission lines. Since a major part of the Aliveri output will be required in the Athens-Piraeus area, one main line will go south to a substation on the outskirts of Athens, connecting with the existing network. Another main system will run north and west through Thessaly, to supply important urban areas. Part of the design of this 150 kV system has been put into the hands of Messrs. Merz & McLellan.

The British-owned Athens-Piraeus Electricity Co. is receiving a Marshall Plan loan for transmission system changes and expansion needed to absorb power from the new development.

Water Power Schemes

The Agra hydro-electric plant will be situated on the Vodas river in northern Greece, forty miles west of Salonika. The Vodas is a spring-fed stream originating in shallow, marshy Lake Nissia about 1,500ft above sea level. The plant will not reduce the water available for irrigation; indeed, ultimately it will even provide additional water for the rich Macedonian plains area. This will be accomplished upon completion of the Ostrovo tunnel which will tap the large natural storage reservoir of Lake Ostrovo to increase the present low water flow in the Vodas river.

The plan provides for enlargement of the Vodas river above Agra to provide a channel capacity corresponding to the maximum requirements of two 20,000 kW turbine installations. The water will run from a diversion dam through an intake system and 1·1 miles of tunnel to the power plant. A regulating reservoir holding about 670,000 cubic metres of water will even out large hourly fluctuations in the water flowing through the plant. About 160 miles of transmission lines will distribute power through Macedonia and Thrace.

The engineering contract has been awarded to the Societá Edison of Milan, and the principal machinery is on order from Italian firms.

The Ladhon hydro-electric plant will be situated on the Ladhon river in the central highlands of the Peloponnesus. The river, with a surface drainage area of 430 square miles, is in large part spring-fed. The power station, utilizing the fall of the river between the Pidima and Spathari bridges, will have a capacity of 50,000 kW. The distribution system will include 220 miles of transmission lines supplying the Peloponnesus and terminating at Athens.

The project involves a dam 108ft high, spanning a canyon above the Pidima bridge, a tunnel about five miles long, a surge tank, a steel penstock and a power plant with two 25,000 kW generating units. This contract has also been awarded to the Societá Edison of Milan.

The Louros hydro-electric plant will be situated on the Louros river, about 40 miles south of Ioannina, the principal inland city of western Greece and traditional capital of Epirus. The river originates near the Albanian border and flows south to Salaora Bay. Although this is the smallest project in the programme, it is expected to meet the needs of the entire Epirus area for a number of years. Initially operated as an isolated system, it may eventually be connected with the rest of the national network.

There will be a diversion dam about 45ft high to the spillway crest and about 330ft long, an intake and pressure tunnel, surge tank, concrete conduit and steel penstock, or alternatively, a shorter tunnel with a canal and open forebay discharging into a steel penstock. A final comparison of these schemes is being completed by the engineers in order to select the best arrangement. The power house will have two 2,500 kW units.

Contracts have been awarded jointly to the Greek firm of E.T.E.P. and the French concern Omnium Lyonnais.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) will be obtainable after 17th October from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

1332. British Northrop Loom Co., Ltd., and Pendleton, J. H.—Means for controlling electric motors. 16th February, 1948. (659054.)

5135. Creed & Co., Ltd.—Facsimile transmission apparatus. 21st February, 1947. (658956.)

16509. Submarine Signal Co.—Radio ranging systems. 23rd June, 1947. (659055.)

17707. Creed & Co., Ltd.—Switching systems for telegraphic transmission. 4th July, 1947. (658959.)

19645. Carter, R. O.—Apparatus associated with telegraph circuits. 22nd July, 1947. (659059.)

21279. Sylvania Electric Products, Inc.—Lamp sealing apparatus. 5th August, 1947. (659060.)

24849. Kolster Brandes, Ltd., Chapman, R., and Trier, R. H.—Loudspeakers. 3rd September, 1948. (659063.)

26288. Radio Corporation of America.—Cathode-ray storage tubes. 29th September, 1947. (658961.)

29643. Boswell, I. I., and Planer, F. E.—Electromechanical transducers. 5th November, 1948. (659066.)

30074. Krebs & Co., Ltd.—Cell for the electrolysis of salt solutions. 12th November, 1947. (658962.)

30778. Boston, D. W.—Thermionic valve amplifying circuit. 20th November, 1947. (659067.)

32824. British Thomson-Houston Co., Ltd., and Choudhury, S. U. A.—Apparatus for synchronizing a.c. machines. 29th November, 1948. (658935.)

1948

1416. Philco Corporation.—Secondary electron emission apparatus. 16th January, 1948. (658972.)

3591. Siemens Bros. & Co., Ltd., Christian, D. A., and Long, D. P.—Automatic telephone and like selective systems. 4th February, 1949. (658970.)

6049. Potapenko, G.—Radio distance measuring apparatus. 27th February, 1948. (658974.)

10360. Westinghouse Electric International Co.—Method of producing phosphors for use, for example, with fluorescent lamps. 14th April, 1948. (658980.)

11692. English Electric Valve Co., Ltd., and Young, A. J.—Cooling radiators for electron-discharge tubes. 21st December, 1948. (658982.)

13159. British Thomson-Houston Co., Ltd.—Reverse modulation valve system. 13th May, 1948. (659080.)

14454. Standard Telephones & Cables, Ltd., Terry, V. J., and Kelly, R.—Regulated electric power supply equipment incorporating rectifiers. 27th May, 1949. (658831.)

15331. Accumulatoren Fabriek Varta N. V.—Process for the manufacture of separators for lead accumulators. 7th June, 1948. (659081.)

16299. Triggs, W. W. (Lemercier Frères).—Electric liquid heating system. 17th June, 1948. (659084.)

23009. Westinghouse Electric International Co.—Electric arc discharge devices. 1st September, 1948. (659090.)

25843. Sadir-Carpentier.—Radio-electric circuits. 4th October, 1948. (659095.)

26277. Philips Electrical, Ltd.—Circuits for automatic frequency correction. 8th October, 1948. (658837.)

26545. Standard Telephones & Cables, Ltd., Cleaver, R. F., and Sothcott, P.—Display arrangements for cathode-ray tubes. 12th October, 1948. (659097.)

27070. Wigan, E. R.—Loudspeakers or telephone receivers. 13th October, 1949. (659001.)

33022. Automatic Telephone & Electric Co., Ltd., and Taylor, R.—Mountings for spark quenching devices. 24th November, 1949. (658845.)

1949

2095. Holloway, C. M.—Self-sealing electric light socket for refrigerator panels. 26th January, 1949. (658847.)

2357. Compagnie Industrielle des Téléphones.—Oscillation generator for frequency-modulation transmission systems. 28th January, 1949. (659174.)

2637. Cook, P. L.—Sound controlling means for hand telephones. 15th June, 1949. (658852.)

3141. Philips Electrical, Ltd.—Thermal electric switches. 4th February, 1949. (658857.)

4336. Westinghouse Brake & Signal Co., Ltd., and Walker, A. H. B.—Apparatus for controlling the voltage applied to an alternating current circuit. 11th January, 1950. (659188.)

4391. Garrard Engineering & Manufacturing Co., Ltd., and Offen, F. J.—Electrical socket connecting means. 23rd November, 1949. (658872.)

4842. Akt.-Ges. Brown, Boveri & Cie.—Thermal power plant with steam generator and gas turbines for producing useful power and driving compressors. 22nd February, 1949. (658876.)

5054. English Electric Co., Ltd.—Electric fuse apparatus. 3rd February, 1950. (658882.)

5233. General Electric Co., Ltd., Robertson, W. B., and Turner, H. C.—Dry-plate electric rectifiers and methods of manufacture therefor. 22nd February, 1950. (659199.)

5682. Gloess, P. F. M.—Method and devices for position transmitting by means of time modulated electric pulses. 2nd March, 1949. (659007.)

5709. Allmanna Svenska Elektriska Aktiebolaget.—Welding electrodes. 2nd March, 1949. (658885.)

7363. F. W. Jelpke & Co., Ltd., and Jelpke, B. J.—Voltage regulators. 1st November, 1949. (659273.)

7707. Atterby, H.—Electric water heater. 21st April, 1949. (659276.)

7778. Hoover, Ltd., Starkey, C. V., and Flint, D. J. W.—Electric motors. 8th March, 1950. (659109.)

7801. General Electric Co., Ltd., McDonald, J. J., and Robertson, W. B.—Dry-plate rectifiers and methods of manufacture therefor. 22nd March, 1950. (659277.)

8187. Stackpole Carbon Co.—Carbon brush structures for use in dynamo-electric machines. 25th March, 1949. (659113.)

8676. Metropolitan-Vickers Electrical Co., Ltd.—Integrating meters of the rotating disc type. 30th March, 1949. (659284.)

9349. Standard Telephones & Cables, Ltd., and Clark, R. L.—Diversity reception employing frequency shift keying. 6th April, 1949. (659125.)

9396. British Thomson-Houston Co., Ltd.—Protective arrangements for electric power systems. 6th April, 1949. (659208.)

9616. British Thomson-Houston Co., Ltd., and Fella, J. H.—Thermally-released electric cut outs. 13th March, 1950. (659209.)

10122. Standard Telephones & Cables, Ltd., Richards, E. A., and Ellison, L. J.—Metal rectifiers. 14th April, 1949. (659131.)

10789. Marconi's Wireless Telegraph Co., Ltd., Fairweather, D., Eaton, R. G., and Beane, N. J.—Mounting arrangements for piezo-electric crystal plates. 22nd April, 1949. (658899.)

11933. Ellis, L. S. E. (Aerotec Corporation).—Electric motor follow-up transmitting apparatus. 4th May, 1949. (659214.)

12164. British Thomson-Houston Co., Ltd.—Starting and operating devices for electric discharge devices. 6th May, 1949. (659215.)

12537. G. H. Scholes & Co., Ltd., Pearce, F. J., and Pearce, G. S.—Three-pin plug-and-socket electrical connector. 29th March, 1950. (659216.)

12993. Igranic Electric Co., Ltd.—Battery-charging control circuits. 16th May, 1949. (659220.)

13081. Hoover, Ltd.—Suction cleaners. 17th May, 1949. (659150.)

13117. Westinghouse Electric International Co.—Gas turbine power plant. 17th May, 1949. (659151.)

13139. British Thomson-Houston Co., Ltd., and Ewer, P. A.—High-voltage electrical insulating bushings. 22nd March, 1950. (659222.)

13858. L. M. Ericsson's Telefonaktiebolaget.—Devices for the generation and modulation of electric impulses. 24th May, 1949. (659157.)

14736. Felten & Guilleaume Carlswerk, Akt.-Ges., and Emmerich, E.—Electric cables provided with an aluminium sheath. 1st June, 1949. (659229.)

14869. Hofmann, E.—Couplings, terminals, plugs, and like connection fittings for electric conductor wires. 2nd June, 1949. (658906.)

15138. Compagnie Générale d'Electricité.—Coaxial cables provided with insulating spacers or wedges. 7th June, 1949. (659231.)

15238. Thermal Syndicate, Ltd., and Irving, R.—Electric immersion heaters. 27th April, 1950. (659233.)

16687. Allmanna Svenska Elektriska Aktiebolaget.—Alternating current motor. 23rd June, 1949. (659243.)

17307. Stemp, V. P., and Buckingham, J.—Radio reflectors. 30th June, 1949. (658915.)

17581. Paschak Co., and Fonovits, G.—Electric relay. 4th July, 1949. (659165.)

19200. Westinghouse Electric International Co.—Magnetic core structure. 21st July, 1949. (659169.)

19312. Carbonetto, S.—Electric drying apparatus. 22nd July, 1949. (658935.)

19559. Libois, L. J., and Gloess, P. F. M.—Electrical systems of transmission by code pulses. 25th July, 1949. (659020.)

19591. G. Turnock, Ltd., and McLeman, W.—Plug-and-socket connectors and switch sockets for electric circuits. 26th July, 1949. (658936.)

20553. Allmanna Svenska Elektriska Aktiebolaget.—Multiplying gear for driving an electrical generator from the propeller shaft of a ship. 8th August, 1949. (659262.)

20555. Allmanna Svenska Elektriska Aktiebolaget.—Air-blast electric circuit-breakers. 8th August, 1949. (659263.)

20560. W. Smit & Co.'s Transformatoren-Fabriek N. V.—High-tension on-load transformer tap-changing switches. 8th August, 1949. (659025.)

21335. British Thomson-Houston Co., Ltd.—Position type telemeter transmitters. 16th August, 1949. (659026.)

21398. Standard Telephones & Cables, Ltd., and Boise, H. C. de.—Variable inductance coil. 17th August, 1949. (658938.)

22225. Westinghouse Electric International Co.—Electrical induction apparatus. 26th August, 1949. (659031.)

22649. Zaugg, S.—Combined electrical pocket lighter and torch. 31st August, 1949. (658940.)

24081. Marconi's Wireless Telegraph Co., Ltd., Collings, R. H. P., Keall, O. E., and Miller, W. F.—Radio repeater stations. 19th September, 1949. (658942.)

26848. Hoover, Ltd.—Suction cleaners. 19th October, 1949. (659039.)

27138. Metropolitan-Vickers Electrical Co., Ltd., King, A. J., and Armour, A. M.—Magnet systems. 21st October, 1949. (658946.)

27394. Westinghouse Electric International Co.—Elastic-fluid rotary apparatus, such as gas turbine power plant apparatus. 25th October, 1949. (659040.)

27717. Soc. des Piles Wonder.—Electric batteries. 28th October, 1949. (659042.)

28656. Knecht, E.—Housings for small electric motors, especially gramophone motors. 8th November, 1949. (659044.)

29310. Standard Telephones & Cables, Ltd., Bray, F. H., and Brown, L. R.—Electric signal storage and re-transmission circuits. 16th November, 1949. (658918.)

29611. Marconi's Wireless Telegraph Co., Ltd., Fletcher, S., and Parsons, M. L.—Supporting arrangements for radio aerials. 18th November, 1949. (658949.)

Amended Specifications

605790. Solvay & Cie.—Electrolysing apparatus with adjustable anodes.

634893. Power-Gas Corporation, Ltd., & anr.—Electrolytic cells.

650488. Radio Gramophone Development Co., Ltd., & ors.—Apparatus for the magnetic recording and reproducing of sound by means of a travelling tape or wire.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 29th September:—

BAHCO. No. 695,796. Class 7. Pumps included in Class 7, electric motors (not for land vehicles), separators (machines), lifts, hoists, elevators, conveyors (machines), bellows (machines) and blowers (machines).—Aktiebolaget B. A. Hjorth & Co., Stockholm, Sweden. Address for service, c/o D. Young & Co., 29, Southampton Buildings, Chancery Lane, London, W.C.2.

HITEST. No. 684,937. Class 9. Insulated electric wire and electric cables.—Falk, Stadelmann & Co., Ltd., Veritas House, 91, Farringdon Road, London, E.C.1.

TRANSBOOSTER. No. B694,000. Class 9. Voltage regulating apparatus included in Class 9.—Westinghouse Brake & Signal Co., Ltd., 82, York Way, King's Cross, London, N.1.

FERROSIL. No. B698,537. Class 9. Telephone diaphragms.—Richard Thomas & Baldwins, Ltd., 47, Park Street, London, W.1.

GUARDION (design). B698,724. Class 9. Electrical instruments and apparatus and parts thereof, all included in Class 9.—F. A. Hughes & Co., Ltd., Bath House, 82, Piccadilly, London, W.1.

DIVATEL (design). No. 699,264. Class 9. Radio apparatus.—Westrex Corporation, New York, U.S.A. Address for service, c/o F. C. Tomlins, 5, Mornington Road, Woodford Green, Essex.

SURATEL. No. 699,371. Class 9. Suppressors for the prevention of interference with television receivers and radio receivers.—Wolf Electric Tools, Ltd., Pioneer Works, Hanger Lane, Ealing, London, W.5.

SERAPH. No. 699,466. Class 9. Electrical instruments and apparatus included in Class 9, wireless sets (complete), and scientific instruments and apparatus.—D. S. Robson, Stenk Villa, Abbeytown, Carlisle.

IMPULSIONEL. No. 699,774. IMPULSIONNEL. No. 699,775. Both Class 9. Electronic apparatus for generating electrical impulses.—Ateliers de Constructions Electriques de Charleroi, Brussels, Belgium. Address for service, c/o Feeny & Feeny, 2a, Charlwood Place, Westminster, London, S.W.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Barrow-on-Soar.—17th September. R.D.C. Three electrically operated centrifugal pumping units at Wanlip pumping station and two at Queniborough. P. I. Cotterell & Son, engineers, 54, Victoria Street, Westminster, S.W.1.

Dewsbury.—12th September. Town Council. Electrical installations in 100 houses on the Chickenley Lane estate. Borough surveyor, Town Hall.

Egypt.—CAIRO.—6th November. Director General, Cairo Electricity & Gas Administration. 63 kV underground cable system and associated transformer and switching stations. (See this issue.)

India.—DELHI.—11th September. Directorate General of Supplies and Disposals. Supply of 437 miles of aluminium cable steel reinforced conductor. (C.R.E. (I.B.) 68903/51. Ten/2879.)*

CALCUTTA.—20th September. Director of Cottage Industries. Supply of 2,900 house service meters. (C.R.E. (I.B.) 69122/51. Ten/2869.)*

Leyton.—2nd October. Corporation. Lighting installation in the public hall, Town Hall. (See this issue.)

New Zealand.—WELLINGTON.—18th September. State Hydro-Electric Department. Supply of power and control cables, cable boxes and switchboard wire. (C.R.E. (I.B.) 68994/51. Ten/2874.)*

25th September. Stores Division, G.P.O. Supply of lead acid secondary cells and re-plating material. (C.R.E. (I.B.) 69220/51. Ten/2888.)*

2nd October. Supply of 1,000 junction boxes. (C.R.E. (I.B.) 69219/51. Ten/2880.)*

Romford.—25th September. Corporation. Street lighting equipment for Gobions Housing estate. (See this issue.)

Rutherglen.—15th September. Town Council. Electrical work in three blocks of 56 flats at Spittal Service Road, Croftfoot Road. T. C. Russell, burgh surveyor, Town Hall Buildings.

Uruguay.—MONTEVIDEO.—28th September. Usinas Electricas y Telefonos del Estado. Supply of 500,000 230 V lamps from 25 to 1,000 W. (C.R.E. (I.B.) 68184/51. Ten/2895.)*

ORDERS PLACED

Durham.—County Education Committee. Electrical installation in additional accommodation at Jarrow Grammar School (£487).—G. F. Ellis & Co. Similar work at Blaydon-on-Tyne library (£242).—Storey & Crowe, Crookhill.

Hull.—Corporation. Electrical installations in 108 houses on the Bilton Grange estate (£4,702); electrical installation at Scarborough Street School (£1,680).—Booker & Tarran, Ltd.

Maidstone.—Borough Council. Re-wiring and replacing electrical fittings in 34 Council houses in Queen's Road (£1,468).—Horton & Childs.

Notts.—County Council Welfare Committee. Electrical installation (including fire alarm bells) at Stanhope House, Bingham (£1,669).—Frederick Lamb, Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—R.C. primary school; Reavell & Cahill, architects, Lloyds Bank Chambers.

Battle.—Secondary modern school for East Sussex E.C.; J. Catchpole, county architect, County Hall, Lewes.

Bebington.—Rebuilding in several stages of Radium Institute on site at Clatterbridge Hospital (£500,000); regional architect to Hospital Board, 5th Floor, Premier Buildings, Church Street, Liverpool, 1.

Birmingham.—Reorganization of works at Keeley Street for Warne, Wright & Rowland, Ltd.; S. F. Swift & Sons, Ltd., 200, Alcester Street, Birmingham.

Works extensions; Charles Churchill & Co., Ltd., Coventry Road.

Extensions to factory, Deritend; Thomas Hadden & Stokes, makers of rolled thread screws.

Additions, etc., Coroner's Court and police flats, Newton Street; H. J. Manzoni, city engineer, Civic Centre.

Buckingham.—Houses (31) for R.D.C.; Scherrer & Hicks, architects, 19, Cavendish Square, W.1.

Burnham-on-Crouch.—Shellfish Research Station, for Ministry of Agriculture & Fisheries; Pitchers, Ltd., builders, 57, Ashburton Grove, N.7.

Bury.—Extensions to works, Tanpits; John Hesketh & Son, Ltd., blacksmiths' engineers, Castlecroft Ironworks.

Chelmsford.—Houses (62), Pleshey, Broomfield, Danbury, Roxwell, Stock and Great Waltham; surveyor, R.D.C. Offices, London Road.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

Chesterfield.—Office block at Church Lane for Kennings, Ltd.; Husband & Co., 388, Glossop Road, Sheffield.

Chichester.—Two blocks of flats, Tower Street; Stanley H. J. Roth, architect, 32, Little London.

Dagenham.—Operating theatre at Rush Green Hospital; North East Metropolitan Regional Hospital Board, 11, Portland Place, London, W.1.

Darlington.—Houses and flats for the T.C. (£16,840); direct labour.

Denbigh.—Permanent dwellings (45) for T.C.; F. C. Roberts, architect, Earl Chambers, Mold.

Doncaster.—Primary school at Warmsworth; J. Dixon (Doncaster), Ltd., Greenfield Lane.

Enfield.—Nurses' home at Chase Farm Hospital; North West Metropolitan Regional Hospital Board, 11, Portland Place, W.1.

Halifax.—Flats (136), Heap Street and Grantham Street; borough engineer.

Omnibus station, Cross Field; town clerk, Town Hall.

Hornsey.—Additional storey at works; Taw Manufacturing Co., Ltd., Campsbourne Works, High Street, N.18.

Hull.—Rebuilding works; Robinson & Speight, Ltd., aerated water manufacturers, Osborne Street.

Motor body building works, Marvel Street and Raikes Street; Fox & Sellers, Ltd., 29, Naylor's Row.

Ilford.—Development of Gaysham Hill site for 96 flats and old persons' dwellings, laundry, etc. (£133,491); K. F. B. Nicholls, town clerk, Town Hall.

Ilkley.—Houses (26), Menston, for U.D.C.; Harrison Builders (Pudsey), Ltd.

Kenilworth.—Motor car works; Wilks, Mackie & Co. (Marauder Cars, Ltd.), Dorridge, near Birmingham.

Kettering.—Houses (42), Grange estate, Stamford Road; Patrick Haugh, borough surveyor, 3, Gold Street.

Keynsham.—Territorial Army drill hall and workshops; Petter, Warren & Roydon Cooper, architects, West Hendford, Yeovil.

Leyland.—New works for Leyland Motors, Ltd.; Harry S. Fairhurst & Son, architects, 55, Brown Street, Manchester.

London.—Rebuilding four-storey offices, Cheapside, E.C.2 (£100,000) for Atlas Assurance Co., Ltd.; Waterhouse & Ripley, architects, Staple Inn Buildings, W.C.1.

LAMBETH.—Flats (238), Studley Road; J. Jarvis & Sons, Ltd., builders, 12, Buckingham Palace Gardens, S.W.1.

STOKE NEWINGTON.—Flats in two blocks (£135,000); Stewart & Partners, builders, 105, Baker Street, W.1.

WANDSWORTH.—Flats (116), Wendelsworth estate development, third phase; Lovett Gill, architect, 41, Russell Square, W.C.1.

Luton.—Factory extensions, 187-195, Waller Avenue; Three Star (Luton), Ltd.

Manchester.—Factory at Bradnor Road, Northenden, for Francis Addie, Ltd.; Drury & Gomersall, architects, 15, Oxford Road.

North Shields.—Fish oil factory for K. Irving & Co., Ltd.; Tasker & Child, Trinity Buildings, New Bridge Street, Newcastle.

Newcastle-on-Tyne. — Outpatients' dept. for the treatment of cancer, Newcastle General Hospital for the Regional Hospital Board, Osborne Road; P. H. Knighton, Board's chief architect.

Flats and maisonnettes (120), with lifts, etc., Hindhaugh Street Re-housing site, and shops on sections "A" and "D," Blakelaw Estate; city architect, 18, Cloth Market.

Northumberland.—Additions in "Orlit" construction at various schools for the C.C. (£90,000); county architect, County Hall, Newcastle-on-Tyne.

Old people's homes at Berwick and Wallsend for the C.C. (£21,000 each); county architect, County Hall, Newcastle-on-Tyne.

Northwich.—Houses at Leftwich Old Hall Estate for U.D.C.: 25, Kemps (Contractors), Ltd., Altrincham. 25, W. E. Jones, Ltd., Middlewich.

Norwich.—Development of estate between Hall Road and Ipswich Road, for 364 houses; H. C. Rowley, city engineer, City Hall.

Nottingham.—Factory at Sandiacre for Thos. Plackett & Sons, Nottingham; Ford & Weston, Ltd., Osmaston Road, Derby.

Drill Hall, workshops, etc., Triumph Road, for Notts T. & A.F. Association; W. J. Simms, Sons & Cooke, Ltd., builders, Haydn Road.

Seaham Harbour.—Houses (40); surveyor, Urban Council Offices.

Sheffield.—Factory Attercliffe Road and Princess Street for Davenport Bros. & Co., Ltd.; architects, J. Mansell Jenkinson & Son, Imperial Chambers, 18, Norfolk Row.

Stalybridge.—Reconstruction of Aqueduct Mill for Cords, Ltd., Tame Street; John Eaton & Sons, architects, Stamford Street, Ashton-under-Lyne.

Tipton.—Development of Park Lane West estate; borough surveyor, Sedgley Road West.

Tiverton.—Primary school, Elmore; H. V. de Courcy Hague, architect, 97, Heavitree Road, Exeter.

Wakefield.—New mule spinning and carding department for W. Wade & Sons, Ltd.; Fairbank & Lockwood, architects, 11, Hallfield Road, Bradford.

Wallsend.—Dairy, West Street; Wallsend Industrial Co-operative Society, Ltd., Carville Road.

Walthamstow.—Extensions to factory; Duroglass, Ltd., scientific glass manufacturers, Blackhorse Lane, E.17.

Welwyn.—Conversion of former film studios into factory premises; Ardath Tobacco Co., Ltd., Worship Street, E.C.2.

West Bromwich.—Erection of new factory; Smith & Morgan (West Bromwich), Ltd., engineers.

Wigan.—Extensions to factory; Colliery Explosives Co., Ltd., Worsley Mesnes, Poolstock, Wigan.